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HOW CHILDREN LEARN

BY

FRANK N. FREEMAN, Ph.D.
ASSOCIATE PROFESSOR OF EDUCATIONAL PSYCHOLOGY
THE UNIVERSITY OF CHICAGO

AUTHOR OF "THE PSYCHOLOGY OF THE COMMON BRANCHES"
"EXPERIMENTAL EDUCATION"; "THE TEACHING
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EDITOR'S INTRODUCTION

In an earlier number of this series of textbooks the author of the present volume presented the psychological principles underlying good teaching of the so-called common-school branches. Instruction in handwriting, drawing, reading, music, spelling, history, geography, mathematics, and the sciences were analyzed into types, and the lessons of psychology applied in a way to be of much help to the teacher of these subjects. In the present volume the author takes up the growth of the child's mind, and shows how good instruction in any subject and in all parts of the school system must be founded on certain general applications of psychology to the teaching process. In reading through the work here presented, it is interesting to note how fully all questions as to proper mental development of children are related to the psychology of the learning process.

The present volume is a valuable study in applied psychology. It concerns itself primarily with a study of the native and acquired responses of children, and the significance of these for educational development and for social control. It is the purpose of education to deal with these native responses of children, stimulating some and repressing others, and in addition to develop in children many acquired responses which will be valuable to them in later life. In the development of the idea that education means the training of the child to respond in ways which society has approved and men have found useful, the author analyzes the ways of responding which are both native and acquired with children, as these relate to their play, imitation of others, self-assertion, social attitudes, use of language, the acquirement

of skills, perceptions, association and memorizing, and the thinking process. He then formulates the general principles of mental growth in children, devotes a chapter to a careful analysis of the much-debated question of the transfer of training, and concludes with a valuable chapter on mental economy and mental hygiene. In a sense the volume at hand is a textbook in educational psychology, revealing to teachers and students how all effective instruction of children must be founded on the utilization and development of the child's native and acquired responses to the stimuli of our civilization.

The book has been prepared for use as a textbook in colleges and normal schools, and for use as a reading-circle book with teachers. An effort has been made by the author to use as few technical terms as are consistent with a fair degree of precision of statement, and to make the statement of general or abstract principles understandable, by the use of illustrations from familiar experiences, to the reader who has not studied psychology. In particular, schoolroom situations have been used continually as the chief source of illustrations and applications. It is confidently believed that this new volume in the series will find for itself a large field of usefulness.

ELLWOOD P. CUBBERLEY

PREFACE

The student and the practical worker in education need to know certain specific and certain general facts regarding the changes which take place in the child's mental attitudes and capacities as he grows more mature — both those which are the accompaniments of physical maturity, and those which are produced by training and education. By specific changes is meant those which are connected particularly with some branch of study, as reading, writing, or mathematics. These have been described in such books as Professor Judd's *Psychology of High-School Subjects*, and the author's *Psychology of the Common Branches.* There remain many changes which constitute important phases in the child's mental growth, and with which the teacher must be acquainted in order to be able rightly to influence his mental growth, but which are not especially connected with any particular school subjects. These it is the purpose of the present volume to describe.

The discussion even of these general mental processes, having as its purpose the furtherance of efficiency in teaching, differs from "pure" psychology of the ordinary sort in at least two important respects. In the first place, it gives very little space to classifying and defining mental processes — and this only incidentally — and is occupied chiefly in describing how the various processes work. Thus, little space is given to a discussion of what memory is, and much space to an account of the way memorizing can most efficiently be carried on. Again, in describing perception, the chief aim is not to define it and distinguish it from sensation or concepts, but to show how perceptions are formed. In the

second place, the emphasis is on the growth of the mental processes rather than on an analysis of their final form. This includes some account of the chief changes which accompany the child's advancing age, and of the changes which take place when any one, adult or child, learns any new thing. The knowledge of how the child's habits, ideas, etc., come to be is a preliminary step to a knowledge of the best means of directing or modifying their growth.

The application of some of the facts which are presented is inherent in the statements themselves. If the whole method of memorizing is better than the part method in certain cases, then in such cases the whole method should be used. In a good many other instances, where the application is not so obvious, some application has been suggested. But a grasp of the principles of mental growth prepares the teacher in some measure to make his own application. To furnish the teacher with devices has its place, but the teacher who is equipped only with devices lacks the means of initiative and development. The reason that psychology has been of so little use to teachers is not so much the fact that the application has been left wholly to him, though this is undoubtedly one reason, as that the kind of facts that have been given are not such as could be applied. The effort has been made in this volume to present briefly those general facts and principles of mental growth which have most direct application to the problems of teaching, and to give the student sufficient suggestion regarding their application to enable him to continue the process of application himself.

The chapter on the nervous system is the most difficult, and may be omitted by classes of immature students without destroying the continuity of the rest of the book. It is profitable to students who are mature enough to understand it, however, because of the notion it gives that mental development is dependent upon certain definite physiological

changes which require time and suitable training for their accomplishment. It is desirable that it be read at the beginning of the course, so that the student may interpret the rest of the discussion in the light of it, and at the end, so that he may understand the nervous system itself better in the light of the mental processes.

I desire to make special acknowledgment to Professors C. Judson Herrick and Roswell P. Angier for helpful suggestions regarding the chapter on the nervous system.

FRANK N. FREEMAN

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CHAPTER I

INTRODUCTION: TEACHING FOUNDED ON THE CHILD'S RESPONSES

Educational psychology deals first with the child's native responses. The business of teaching is to awaken the right kind of responses in the child. This is a very different task from that of merely presenting to the child the facts it is assumed he ought to learn. We must know what kind of reaction the child is likely to make to the situations which are presented, and whether these reactions are such as to lead him to acquire the information, form the habits, take the attitudes, or develop the ideas which will fit him to meet the demands of his life. In order to know how best to guide the child in the development of these desirable habits, attitudes, etc., we must know something of his instinctive responses. In common with the animal the child performs many actions and takes many attitudes without being taught. The general form which his play takes, his feelings and emotions, and to a large extent the interests which are the driving forces of his intellectual growth, are governed by his inborn nature. We must therefore study the facts of this instinctive nature and its development.

Another branch deals with the modes of learning in the school subjects. We must also know the laws according to which these instinctive responses become developed and modified by training and selection, so as to form the specific habits of conduct of the fully furnished adult person,

equipped to meet the demands which life makes on him. One group of these principles is concerned with those habits which constitute the mastery of the various branches of study in the school. We study the kinds of learning which are demanded by these subjects of study, in order to discover how they may be most economically acquired. We must know how the child learns to read, write, calculate, etc., and the stages of development through which he passes in these forms of learning. This study forms one branch of educational psychology — the branch which deals with the *psychology of the school subjects.*

A third branch deals more with the general principles of learning. Besides the specific forms of learning which are immediately connected with the acquisition of the school arts, the child's education produces certain more general habits and attitudes. The development of manual skill takes place in a variety of school subjects, as writing, sewing, drawing and modeling, wood-working, and language pronunciation. The development of the ability to memorize economically may take place in connection with literature, language, history, geography, science, mathematics — in fact to some degree in connection with all the school subjects, and so with fixing associations and thinking. The general principles which govern these forms of learning may be treated, and this treatment comprises the greater part of what is called the " psychology of learning." Connected with the consideration of the principles governing the various forms of learning just mentioned are certain still more general questions. The first of these deals with the problem of so-called " transfer of training," and the second with the general condition of " economy in mental work."

Scope of this book. Three groups of questions have been outlined — those concerned with the development of the child which is due to instinct or inner growth, rather than

to outside influences; those which are bound up with the processes of mastering the various school subjects; and those which deal with the more general phases of learning. This book will deal briefly with the first and third topics. The second, being more specialized, is more easily treated separately.

In order to understand more clearly how teaching is concerned with the native and acquired responses, we must stop to consider what we mean by responses, and what are the different kinds of responses of which the child is capable.

Responses may consist in movements or in the prevention of a movement. When we speak of responses one is instantly led to think of active responses consisting of outward movements. They are the most obvious, it is true, but the prevention of a movement is a response to a situation as truly as is the making of a movement. If a child is sitting in a schoolroom and hears a circus parade outside, the instinctive response to this insistent form of stimulus [1] is getting up and looking out of the window. If the child remains in his seat he is responding to the school situation by actively preventing the movement of getting up and going to the window. This checking of a response is called "inhibition." If we compare the adult with the child, or the highly civilized person with the primitive man, we find that education has consisted in a great many instances in inhibiting the natural, spontaneous movements which are made in response to certain stimuli. On the other hand, primitive man has certain inhibitions which civilized peoples have outgrown. Children of one community have to acquire certain sorts of inhibition and children of other communities must acquire other sorts. The effect of the action of the brain, which is

[1] A stimulus is any object or any occurrence which may affect an individual's sense organs and arouse within him a sensation, idea, or movement — that is, any form of response.

the most highly developed part of the nervous system, is to slow down the mechanical reflex movements of the spinal cord which are of an instinctive nature. When the brain of the frog is severed from the spinal cord its foot will be withdrawn from contact with a hot object more quickly than when the brain and the cord are connected in the normal way.

Some responses are hidden. Not only is the inhibition of movement a form of response as well as the production of a movement, but there is also a distinction between the easily observed movements and those which are hidden from sight. We make responses to the presence and actions of other people which do not always appear as outward or easily observed forms of movement. The emotions which are aroused within us, and which frequently constitute the response which we make to other persons and their actions, have been shown to be accompanied by movements within the body. For example, the blood vessels in the skin of the face may dilate, causing the face to flush, or they may contract and cause paleness. The muscles of the chest and diaphragm may become tense, causing restricted breathing. The heart may beat more rapidly. The muscles of the limbs and body may stiffen or relax. All of these accompaniments of the emotions, as of fear, shame, anger, etc., are as important forms of response as are outward movements.

Speech is a response. The most important form of social[1] response consists of speech movements. While speech does not cause any direct change in the physical objects about us, yet it does have an important indirect effect, even on the physical world, through its action on other persons. It is as

[1] Here and throughout the book the term "social" is used in the broad sense of pertaining to the relations of persons to one another, and to the effect of the existence and conduct of other persons on the individual's mental life and growth.

true a form of response to give a command or reply to a question as it is to wield a club or to make a table. But speech has its greatest importance from the fact that it is the chief means of that communication between persons which is the origin of all the more complicated forms of thinking and of the recording of thought. These in turn make possible the accumulation of knowledge, and the development of literature, history, and science.

Inner choice is a response. There are also certain inner forms of response which seem to be still more remote from any kind of movement, and which may yet affect our conduct in the long run equally with these more obvious reactions. This kind of response consists in the inner decisions which we make, or the mental attitudes which we adopt, and which govern a large share of our future conduct. The existence of this type of response makes it evident that the description of mental life as made up of responses to stimuli does not mean that the individual is at the mercy of the outer situations which confront him. It is possible for him to choose among the various courses of action which are open to him the responses which he shall make. To say that one's mental life consists in adaption to the environment, or in response to stimuli, does not mean that the inner character of the mental life is not important.

The human being has a wide choice of responses. This possibility of choice of responses which confronts the human being is due to the fact that he is capable of responding to so many different kinds of stimuli, and of making so many different kinds of responses. The animal is sensitive to stimulation by comparatively few physical objects, and by a few actions of other animals, and responds by a narrow range of movements. The human being is affected by a vastly greater variety of events in the physical world, and above all by the expression of ideas and feelings of other hu-

man beings through spoken and written language. Through the great variety of his responses, and through his social relations, things come to have a richness of meaning far beyond the simple meanings they have for the animals. This richness of meaning is enhanced by the ability to recall the experiences of the past and to forecast those of the future. With the wide range of responses which are made possible by these facts, the human being is called upon frequently to select the stimulus to which he will respond and the kind of response he will make.

Reflection is typically a human response. The large capacity for a wide choice among responses grows out of the fact that a human being may not merely make an immediate reaction to a stimulus, but may think over or reflect upon the situation. By this means he puts together different parts of his experience in such a way that he may react to it as a whole instead of to each moment as it is presented to him. He may carry on with himself a sort of inner conversation, the immediate result of which does not appear in immediate outward action, but in drawing conclusions, in forming ideas, or in acquiring permanent attitudes toward principles of conduct.

Responses may be direct or indirect. These forms of reaction may be called indirect ways of responding because, while they do not result in immediate reactions, yet they do affect our reactions at a remote time. When the primitive man pauses in the process of making a club or hatchet, and reflects on the various methods which might be used, or the various application of the material he is shaping to different uses, he may be starting a whole train of activities which are not completed until some distant future time. When a student listens to a lecture on Education, the response which he is making at the time is one of thought or of reflection; but at some future time, when confronted by the practical

situation of the schoolroom, this reflection may result in a definite outward form of response.

Summary. It will be evident from this discussion that when it is said that education consists in developing in a child proper responses it is not meant to confine education to the more obvious forms of bodily movement. Responses have been shown to consist not merely in movement, but in the inhibition[1] of movement; not merely in responses to objects of the physical world, but also to persons and their mental attitudes; not merely by immediate, outward movements, but by inner decision which may govern a whole train of reactions; and finally, not only by immediate reaction, but by thought or reflection.

The child's responses are affected by his stage of development. The study of the child and the responses which he makes has led to the formulation of general principles which make it possible to predict, within certain limits, the responses which a particular child will make. In the development of the child different sorts of response are prominent at different times. In early life a child is particularly prone to make outward movements in response to stimuli. As he grows older he learns to check these movements. It is evident to any observer of the child that he is impulsive, that he does not stop to compare different courses of action, or to deliberate which course he shall take. The response which consists in making inner decisions, therefore, is one which comes as the result of gradual mental development, and is partly due to the growth of the ability to check the more natural, immediate, outward responses. The response by reflection or by thought

[1] Inhibition of a movement means the checking of a movement which is being made, or the prevention of a movement which would be made if it were not for the inhibition. Thus a strong emotion will check or inhibit the movements of the stomach in digestion.

is the highest product of the child's education. It begins in the early years, it is true, and should be encouraged throughout his education, but it becomes more and more prominent as he grows older.

The principle of response has important educational applications. The purpose of the rest of this book is to show how these different kinds of responses are developed in the child by his education. The fact that education does consist in developing responses is emphasized here, both because the importance of the general principle needs to be clearly recognized, and because it is necessary to guard against a one-sided application of the principle. The one-sided application of the principle has already been suggested. It consists in giving sole attention to the responses which the child makes through outward, bodily movement. The consequence of this perversion is the over-valuation of manual training as a means of mental development. Manual training may be made a means of intellectual development; but it becomes so rather through the interest it awakens and through the stimulation it may give to the higher forms of response by speech and reflection, than through any mysterious and direct influence it may be supposed to have on the brain or the mind.

The true application of this principle of response is much broader than this. When it is stated, it seems obvious, and yet it has been and often is disregarded. It may be put thus: it is not what is presented to the child which educates him, but rather the reaction that he makes to what is presented. Certain children may fail entirely to respond to a lesson, or may respond in a wrong manner. If a child's response to his geography is to memorize the words, without any understanding of the facts they represent, the lesson is not educative for him, although it may be educative for the child next him who reacts properly. The responses of which a

child is capable depend upon his stage of development, his previous experiences, his ability and his interests.

Education is concerned with the specific and the general responses. The preparation for life which the child receives through his education includes the development of responses which are suited to certain specific situations, and responses which are more general in their application. In each of the particular subjects of the curriculum the child learns to make certain specific responses. In handwriting he develops special habits of movement. In number work he develops habits of association which we call addition, subtraction, etc. In addition to these specific forms of response, the child learns to react in certain ways to the presence of other people. He learns to be obedient, to be considerate of the interests of others, to be fair and just in his judgments on the actions of others. We sum this up by saying that he acquires responses to social situations. The child develops, or should develop, certain kinds of control over his actions and over his mental processes. He should learn to continue the pursuit of a problem until he has arrived at the conclusion; he should learn to neglect certain feelings of weariness and continue his work in spite of them; he should develop a notion of accuracy in his work, etc. In these ways the child develops modes of response which are not confined to any particular situation, but which will apply to a variety of situations.

It is assumed that general types of response can be developed. How far it is possible to develop in the child, not merely specific forms of response, but these general types of reaction, is a matter of debate. The development of the ability to respond in this general way is sometimes called transfer of training or formal discipline. We have assumed that such transfer of training is possible and is important for the child's education. In a later chapter we shall take

up this question, and the arguments which are advanced on both sides, in some detail.

QUESTIONS AND TOPICS FOR DISCUSSION

1. Give an example of the specific things a teacher might do in applying the principle that teaching is concerned not merely with presenting material, but with the child's response.
2. Illustrate the native responses by citing two animal and two human instincts.
3. Mention some principle of learning which is particularly illustrated in one of the subjects of study in the school. If necessary look up the question in a book on teaching reading, writing, number, spelling, or one of the other branches.
4. Illustrate your conception of economy in mental work.
5. Give instances of situations in which it is necessary to learn to inhibit. Do you know of any inhibitions which are possessed by primitive people which are not possessed by civilized people? Look up under the head of *Taboo*.
6. Look up the James-Lange theory of the emotions and show how it illustrates inner responses.
7. Illustrate further the value of speech as a response.
8. Do you think inner choice is independent of any bodily response?
9. Compare the range of objects to which a chick and a child are responsive.
10. When is outward bodily activity in the child to be discouraged, and when not?
11. Look up some argument for manual training and connect it with the discussion here.
12. What are some of the general responses which are assumed in this chapter to exist?

CHAPTER II

THE NERVOUS SYSTEM, THE BODILY ORGAN OF RESPONSE

The view that the mental life consists in responses to stimuli is in agreement with what we know about the structure and mode of action of the nervous system. If this is the case, it gives a confirmation to our view of the nature of both the nervous system and mental life, because there is a close connection between bodily movements and mental activity on the one hand, and the action of the nervous system on the other. In fact, the nervous system may be called the organ of response and also the organ of the mental life. The evidence of this close connection is of many sorts. In the evolution of animals it is found that the higher in the scale we go, the more prominent is the nervous system, and particularly the higher part of the nervous system which we call the brain. It is a matter of common experience also that injuries to the brain cause derangement in movement, in sensation, or in thought. This connection is so close that it has been determined that the stimulation of certain parts of the brain produces definite movements or makes possible certain particular kinds of sensations. Experiments with animals have demonstrated the definite connection between certain areas of the brain and specified movements.

The larger divisions of the nervous system

In describing the development of the nervous system and comparing the nervous system of the human being with that of the lower forms of animals, we have seen that the brain is more highly developed the higher we go in the scale of evolution. This leads us to consider the divisions of the nervous

system and the location of the various arcs which have been described in the nervous system.

The two main divisions of the nervous system. The division of the nervous system which is most important for mental development is situated chiefly in the skull and the spinal column. The fibers of this system which pass to the sense organs and the muscles extend, of course, outside these bony cavities, but most of the cell bodies and all of the connecting neurons are within them. It is this whole cerebro-spinal division to which we have thus far been referring, and with which we shall be concerned throughout the book, because it is this division which is involved in the movements of the body as a whole and of the limbs, and chiefly, so far as we know, with learning and thinking.

The sympathetic system. The other main division of the nervous system, the sympathetic system, consists of a large number of ganglia (groups of cell bodies) and their nerves, scattered throughout the body. In general these ganglia exercise local control over the organs with which they are connected. An important series of ganglia of this system lie in two rows near the spinal column, and, in association with centers in the spinal cord, exercise control over digestion, breathing, circulation, excretion and reproduction. Most of the activities of the sympathetic nervous system do not directly affect consciousness; and, while some of them do have a vague influence on the feelings, they may be neglected in a consideration of the nervous basis of mental growth.

The peripheral and the central parts of the cerebro-spinal system. We may divide the cerebro-spinal system into two main parts, one of which is composed of the nerves which lead from the sense organs to the spinal cord and the brain, or of the nerves which lead from these central parts to the muscles. These nerves are sometimes called the peripheral part of the nervous system. The rest, which is located within

the spinal column and the skull, is called the central nervous system.

The divisions of the central nervous system. A general view of the chief parts of the central nervous system is given in Figure 1. We may readily distinguish the large mass which is located in the skull. The general term for this mass is the brain. Contrasted with this is the spinal cord which is situated in the spinal column. Each of these has subdivisions which may be studied by consulting works on anatomy or physiological psychology, but we shall describe here merely the outlines of the chief parts.

FIG. 1. THE BRAIN AND SPINAL CORD, VIEWED FROM THE SIDE, IN THEIR RELATION TO THE GENERAL STRUCTURE OF THE BODY

One seventh natural size. (From E. L. Thorndike's *The Elements of Psychology*, by permission of the author.)

The nerve circuits

The nervous system is composed of stimulus-response circuits. The nervous system is made up fundamentally of a series of arcs [1] or paths of discharge which connect the various sense organs [2] with the

[1] A nervous arc is a series of nerve units leading either directly or indirectly from a sense organ to a muscle.

[2] The sense organs are structures in the body which are sensitive to various kinds of stimuli. Thus the eye is sensitive to either vibrations or to light; the ear, to air vibrations or to sound; the

muscles of the body. For example, there are certain neurons[1] which connect the sensitive part of the eye, the retina, with the muscles which move the eye. There are paths of discharge in the nervous system which connect the organ of taste in the mouth with the excito-glandular fibers in the salivary glands in the mouth. There are other paths of discharge connecting the lining of the nose with the muscles which produce sneezing, etc. The foundation of the nervous system is to be thought of as composed of such a series of neurons as these leading from sense organs to muscles. It is clear that if this is a correct description of the nervous system it is entirely in agreement with our view of the mental life as being made up of responses to stimuli. We shall see that this agreement is not only true in a general way, but that it holds with the different kinds of responses which can be made. Just as there are more direct and simpler forms of responses, so there are simpler kinds of nerve arcs; and just as there are indirect, more complicated kinds of response, so there are circuits in the nervous system which are appropriate to produce these kinds of reaction.

The Levels of Response

The first level

The reflex arc. The simplest, most elementary form of stimulus-response circuit in the nervous system is illustrated in the examples given above. The neurons which connect a sense organ, such as the eye, with muscles which produce a response following immediately and invariably upon a par-

skin to contact with physical objects, and to heat and cold. Besides these are sense organs for taste and smell, movement and strain, and for certain vague sensations, as for hunger.

[1] The neuron is a nerve cell and its branches, which conducts the nervous impulse from one part of the body to another. A more minute description is given later in the chapter.

ticular kind of stimulus, make up what is called a reflex arc. The structure of the reflex arc is illustrated by means of the diagram in Figure 2. The response which is made when a reflex arc is stimulated is called a reflex act. For example, the pupil of the eye enlarges or contracts in response to the decrease or the increase in brightness of the light which falls upon the retina. This response follows invariably and immediately upon the stimulus. It is a response which is not made intentionally; and, in fact, is a response of which we are not conscious. Of other reflex acts we may be conscious, but they are carried on independently of our intention or perhaps in spite of it. Sneezing and coughing are good examples of such reflex acts. We may think of these reflex acts as like the earliest kind of response which an animal is capable of making. Even the animal which consists of but a single cell is able to react by moving toward a favorable stimulus and moving away from that which is harmful. As animals grow more and more complex through evolution, they acquire a larger number of these reflex acts. The human being possesses a great many of them.

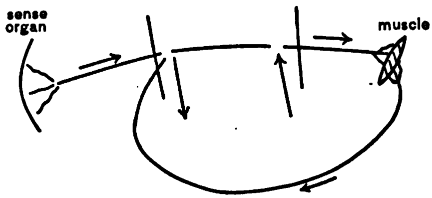

FIG. 2. DIAGRAM OF REFLEX CIRCUIT

The reflex act is not completed when the outward response is made. When we sneeze or cough we are aware not only of the existence of the annoying object or condition which produced the response, but we are also aware of the act itself. When we withdraw the hand from the hot stove we are conscious not merely of the burn, but also of the jerking back of the hand. In the reflexes which are carried on entirely without our awareness there is still a return current

from the muscle to the central link of the arc. The return current is not a continuation of the nervous current which is produced by the original stimulus, but is a new current produced by the contraction of the muscle, which acts as a new stimulus. This return current is represented by the lower line in Figure 1. This return current often serves to start a second response, and this may be followed by a third, and so on. Since the stimulus is thus followed by a return current in addition to the current which produces the movement, it is appropriate to speak of the system as a " reflex circuit,"[1] instead of a " reflex arc." We shall accordingly use this completer term.

Reflex acts are combined to produce instinctive action. Many responses are very similar to reflex acts except that they consist of chains of movements rather than of single movements. Each movement in the series may be thought of as a response to the situation created by the previous movement in the chain, as well as to some aspect of the external world of objects. Thus a beast of prey in stalking its victim responds to a series of smells and sights as they appear from one instant to another as a result of its own movements or the movements of its prey; and also responds by each successive movement in stalking, crouching, leaping and seizing and tearing, to its own bodily movements and positions which form the preceding links in the chain. In human beings the act of walking is an illustration of a chain of reflexes which together compose an instinctive act.[2] Such chains of reflexes, which make up an instinct, differ from single reflexes, in that instinctive acts depend more on the

[1] A reflex circuit is a reflex arc plus the return path leading from the muscle back to the central part of the circuit.

[2] An instinctive act is an inborn or inherited form of response, like a reflex act, but is distinguished from a reflex act in that it consists of a whole chain or series of acts. Both reflexes and instincts serve a useful purpose, but the purpose served by an instinct is more remote.

internal condition of the animal and are somewhat less fixed and machine-like in their operation. It is probable also that we should regard an instinct as something more than merely a series of reflexes. It is necessary to explain how the succession of acts which make up the instinct come to be arranged in this order so as to be so nicely adapted to produce a useful and satisfactory result. This explanation is supplied if we regard the series of reflexes taken together as combining to form a reaction to an object, and each step as a stage toward the completion of the act as a whole. Thus, a swallow which returns from its Southern migration to the same chimney in the North is really reacting to the chimney throughout the whole course of its journey.[1]

Internal bodily adjustments correspond to emotions. Many instinctive acts consist of internal responses. The sight of a wild animal or the sound of thunder may cause trembling of the legs, tension of the abdominal muscles, slowing-down or holding of the breath, weakening or quickening of the heart-beat and contraction of the blood vessels of the skin producing paleness, or other internal responses. These are some of the familiar symptoms of the emotion we call fear. The other emotions have their own forms of internal bodily responses. The emotions and their accompanying bodily responses form an important class of instincts.

The mechanism of instinctive acts. Instincts are carried on through the coöperation of whole series and groups of reflex circuits. This union of circuits into groups is effected by means of paths joining the different circuits at their central parts, as indicated in Figure 1 by the vertical arrowhead lines.

The reflexes and primary instincts may be modified slightly. The instincts and reflexes have been described as invariable. This is true only comparatively. The chick's

[1] The author is indebted for this illustration to Professor R. P. Angier.

general reflex tendency to peck at small objects becomes modified as the result of the experience of getting a bad-tasting worm into its mouth. Henceforth a discrimination is made, and the tendency to peck at this worm is checked. The spider's instinct for building its web is modified in some of the details to suit the position of the objects which furnish its support. If we think of an instinct as an inherited means of reaching a goal useful to the animal, we must recognize the possibility of some slight variation in this means of attaining its end.

Some human instincts are less definite. Besides these comparatively fixed instincts there are in human beings certain attitudes and types of activity which are universal and evidently inherited and not learned, though they are not represented by particular, fixed sets of acts, but now by this and now by that particular act. We may perhaps regard the home-building impulse in human beings as such an indefinite instinct. It is not represented by a series of definite acts, each of which may be a reflex, as in the case of the nest-building instinct of birds or the web-building instinct of spiders. But it is none the less a native impulse which must be based on some inherited organization in the nervous system.

The level of sensori-motor learning and perception

Habit formation is an advance beyond instinctive action. In the higher animals, and preëminently in human beings, the individual acquires modes of meeting the situations which confront him, and of satisfying his needs and impulses, which are not simply slight modifications of instinctive actions, but are radically new. When confronted by a situation to which no instinct furnishes a satisfactory response, the higher animal or man finds a new mode of response; and finally, after sufficient repetition, crystallizes

the new response into a habit. The habit then becomes in some respects like an instinct, but is different in its origin.

Illustration: Sensori-motor learning in the cat. An illustration of habit formation may be found in the action of a cat in escaping from a cage. If a hungry cat is put into a cage, the door of which is fastened shut by a latch or string so constructed that the animal is capable of opening it, the cat first goes through all manner of clawings and scratchings which are its instinctive mode of getting out of close quarters. Finally, out of this variety of movements one by chance presses the latch which opens the door and the cat escapes. The next time the cat hits upon the correct movement somewhat more quickly, and the next still more quickly, until finally it responds immediately with the correct movement, and a new stimulus-response circuit or habit has been formed.

Learning is effected by means of additional, superimposed, arcs. What arrangement in the nervous system makes possible the formation of such new circuits? The systems of reflex circuits allow of some slight modification, but there is an additional system which much more readily allows the formation of such new circuits. Leading upward from the reflex circuits are paths of connection with higher centers. These higher centers may be compared roughly to a tele-

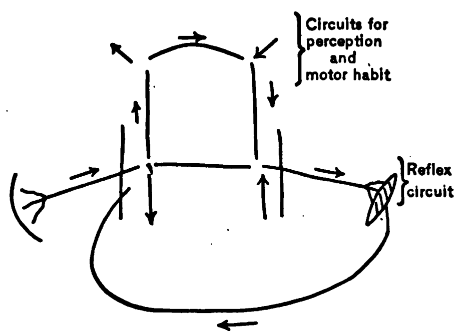

FIG. 3. DIAGRAM OF THE CONNECTIONS IN THE LEVEL OF PERCEPTION AND MOTOR HABIT

phone switchboard. Each incoming wire may be connected in these centers with any one of a great many outgoing wires. This possibility is suggested by the diagram in Figure 3. This nervous organization has the additional property, unlike the telephone exchange, of uniting many of the paths, either incoming or outgoing, into groups or systems.

Perception is developed by many responses to the same object. From the time when the infant begins to play with his ball or his rattle, he begins to do a variety of things with the same object, and in doing so to gain a variety of experiences from it. He grasps his rattle and gains from it experiences of movement and touch. He runs his hand over it and enriches his experience. His eye falls on it while he is waving it and another connection is made between this thing with the familiar feeling and a thing that has a certain appearance of brightness. His eye explores the object and in doing so gives a new combination of experiences of eye movement with those of sight which gives him a more definite apprehension of its shape. The sound of the rattle falls on his ear and this is added to the qualities of this strange thing, beside giving a new starting point for the development of a new sense of direction. The uniting of a variety of experiences in an object, which thus takes place through the variety of responses to it, is designated by the term perception. It is but the other side of the union of responses into habit groups. The one is viewed from the standpoint of the combination of stimuli, the other from the standpoint of the combination of movements. Neither takes place alone, and both are made possible by the higher nerve circuits.

Consciousness guides in sensori-motor responses. The reflex actions, as we have seen, may take place without our being aware at all that they are being made. When the nervous impulse passes to the second level, however, we become

aware of the stimulus which causes the response. In a good many reflexes this stimulation of the higher arc regularly takes place. When we sneeze or cough, the cause of the reaction produces a sensation, but the reaction would take place whether we had the sensation or not. The action ceases to become a reflex when consciousness not merely accompanies the act but produces some modification in it. This more advanced type of response, in which the movement is guided or modified by the sensation which is received, is appropriately called a sensori-motor response. The difference between the reflex and the sensori-motor response may be illustrated by comparing the act of withdrawing the foot when it is tickled with the process of learning to skate. Withdrawing the foot is a reflex act, which is accompanied by a sensation produced by the stimulus which sets off the response and by the response itself. But the sensation may be regarded as superfluous since the act would be carried on if the person were unconscious, as in sleep. In learning to skate, on the other hand, the sensations which accompany gaining or losing one's balance are used directly to select the kind of movements which maintain balance and eliminate those which destroy it.

The level of ideation

The use of ideas represents a still less direct response. We saw in our catalogue of the different kinds of responses of which the human being is capable that there are many responses which do not consist in immediate, outward actions, but which rather consist in thinking or in reflection. In the nervous system also there is a division which corresponds to these remote or indirect types of response. This division we may call, in distinction from the others, the third level. As the second level consisted in arcs which were superimposed on the reflex arcs of the first level, so the third level

consists in still further and much more complicated arcs superimposed on those of the second level. (See Figure 4.) This form of structure makes it possible for a stimulus to set up not merely a direct, outward response, but also a variety of activities in the nervous system which do not immediately issue in impulses to the muscles.

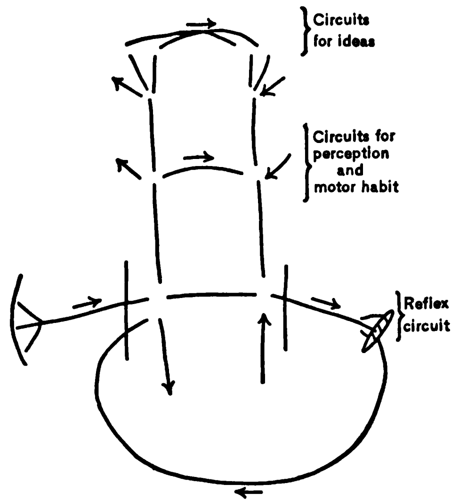

FIG. 4. DIAGRAM OF THE CONNECTIONS IN THE LEVEL FOR IDEAS

Illustration. The contrast between the responses of the second and third level may be illustrated by a comparison of the way in which a cat finds its way out of a cage which is fastened by a latch, with the way in which a human being might attack a similar problem. The method which is pursued by the cat is merely to make a great many movements of clawing, scratching and reaching, until finally one of these movements presses the latch and opens the door. The satisfaction that follows the successful movement gradually causes it to be selected out of the mass of useless movements, and in this hit-or-miss fashion a sensori-motor connection is made. The human being when confronted by such a situation *may* respond in the same way, but he is capable of responding in a different manner. He *may* sit down and call to mind other experiences which he has had with locks,

facts he has heard or read about them, or the reasons which lead one to suppose that one kind of fastening rather than another had been used in this instance. After the lock has been opened he may draw conclusions from his experience to help him in meeting a similar problem another time.

The higher processes consist in associations of ideas. On the mental side we may call these various responses associations. The stimulus may call to mind a great variety of ideas, and these ideas in turn may call up other ideas or trains of thought. This process of association of ideas with one another may be carried to great length and constitute what we call thought or reflection. The nervous impulses which are set up ultimately issue, it is true, in paths of discharge towards the muscles; and the thoughts or reflections which are caused ultimately lead to conduct; but the associations and thoughts themselves are so important that we come to think of them as being only remotely connected with the stimuli which arouse them or the actions by which they are expressed.

Summary. We see, then, that the nervous system may be thought of as composed of different levels. 1 On the lowest is the simple reflex arc which produces the mechanical reflex or instinctive acts. 2 On the second level we have sensations and perceptions, and these sensations and perceptions serve to govern in an immediate way the kind of response which is made. The actions of this level we call sensori-motor responses. 3 On the third level we have represented all of the higher mental processes, in which we do not respond immediately and directly to the objects of our environment, but through which we associate these objects with other experiences which we have had, anticipate future results of our actions, consider their relation to other actions, and in general reflect upon the stimulus or the response to be made.

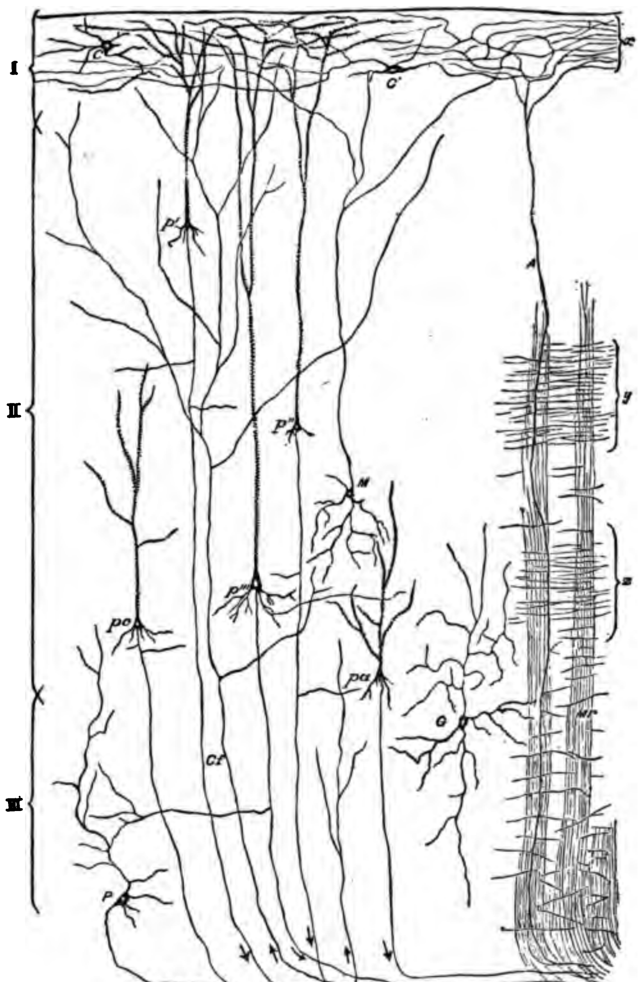

Fig. 5. Scheme of the Principal Neurons of the Cerebral Cortex

p′ p″ and *p‴* are "pyramidal" cells, the axons of which convey impulses to the muscles in various parts of the body. *pa* and *pc* are neurons, the axons of which convey impulses to other parts of the brain. *C* and *C′* are neurons which connect near-by areas. The axons of neurons, the remainder of which are in other parts of the nervous system, which convey impulses toward the region which is here shown, are indicated by the arrows pointing upward. (From Foster, *Textbook of Physiology*.)

The neurons and their connections

The branching of the neurons connects the different arcs with one another. With this general scheme of the mode of action of the nervous system in mind, we may turn to a description of the detailed structures which compose these general systems of arcs. The nervous system is made up entirely of groups of nerve cells, called neurons. The simplest kind of arc always consists of at least two or three of these neurons placed end to end in a series, as shown diagrammatically in Figure 1. We shall see that this fact, that even the simplest reflex arc is composed of more than one neuron, is what makes possible variation in response, and the connections between the different arcs and levels of the nervous system. If a single neuron led from a sense organ to a muscle, there would be no means, according to the structure and function of the neuron as it is now conceived, by which the impulses might be diverted to the brain or to some other muscle. The presence of intermediate neurons in the nervous arcs introduces junction points between the successive links of the chain, at which the branches of the neuron are connected with other arcs besides the one to which it belongs. Thus one branch of a neuron entering the central system from one sense organ may be connected with a neuron leading to a near-by muscle, while another may lead to a more remote muscle and a third to the brain. As a consequence an object touching the hand may result in withdrawal of the hand or clasping the hand about the object, and also in a movement of the other hand, in the movement of the mouth in speech, or in the movement of the body as a whole, as in walking.

The structure of the neuron. The way in which this distribution of impulse is possible may be seen more clearly from a description of the detailed structure of the individual

neuron. A neuron is composed of a cell body and a large number of prolongations extending from it. These prolongations are of two sorts. As shown in Figure 5, one kind of prolongation consists in numerous filaments having many branches which ordinarily do not extend far from the cell body. These branches, because of their tree-like appearance, are called dendrites (from the Greek word dendron, tree). Ordinarily they carry the nervous impulse toward the cell body. The other kind of prolongation is usually long and has fewer side branches. There is but one of these to a cell and its side branches go off more nearly at right angles to the main stem. This prolongation is the axon and usually carries the nerve impulse away from the cell body. This whole structure, composed of the cell body, dendrites, and the axon, is called the "neuron."[1]

It will be readily seen how the structure of the neuron makes it possible for an impulse to be gathered from a variety of sources through the dendrites and to issue in a variety of directions through the branches of the axon.

Resistance at the connections determines the direction of the nerve current. In view of the great number of interconnections between the neurons and the great variety of directions which the impulse may take, the question immediately arises as to what it is that makes the nervous impulse more likely to go in one direction than in another. We found that there were a great many reflex acts in which a particular stimulus is almost invariably followed by a particular kind of movement. Since each reflex arc has superimposed upon it another arc of the second level, and since the sensory nerve is connected with other muscles as well as with those

[1] The neuron is the structural unit of the nervous system. It consists of a single nerve cell, composed of the cell body which is the nutritive center of the cell, and of two kinds of branches: the dendrites which are usually short and carry impulses toward the cell body, and the axon which is usually long and carries the impulse from the cell body.

of the immediately associated reflex, how does it happen that, in a reflex or a habit, a particular reaction is almost sure to follow a particular kind of stimulus? The answer of this question is to be found in the peculiar character of the connection between the branches of one neuron and those of another. This connection is of such a nature that it may offer a low-resistance or a high resistance to the passing of the nerve current. Thus, although a neuron may be connected with a great variety of other neurons, the resistance at the points of connection with certain neurons may be so much lower than the resistance at other points that most of the nervous current may pass immediately over to the one rather than to the other set of neurons.

Resistance at the synapses may be low through inheritance or through training. These points of connections between different neurons have been called synapses. The meaning of the word synapse [1] may be readily grasped from its derivation. It comes from two Greek words meaning " together " and " unite," so that it means the place where branches are joined together. We have found that there are two ways in which a connection between a stimulus and a response may come into being. There are certain of these connections which are inborn, and there are others which are formed through the experience or the activities of the individual during his life-time. We must therefore assume that there are certain synapses at which there is a low resistance through the inborn structure of the nervous system, and that there are other synapses at which the resistance becomes low as the result of some kind of training. The higher up we go in the nervous system, the more numerous the interconnections between neurons become, and the less

[1] A synapse is the surface of contact between the axon of one neuron and the dendrites of another, at which the nerve current passes over from one neuron to another.

is any particular connection as compared with others determined by inherited structure.

Summary. A person acquires appropriate responses, then, through the development of preferred paths of discharge by means of a lowering of resistance at certain synapses. We may think of the brain of the child as being made up partly of certain paths of low resistance at the start, and as also including many points of contact at which there is not much greater probability at the beginning that the nervous impulse will pass over one path than another. Development consists in the selection of certain paths of discharge and the lowering of resistance so that the nervous energy passes in one direction more easily than in others.

The location of the nervous arcs in the brain and spinal cord

In order to avoid misconceiving the statements which follow regarding the location of different level circuits it must be clearly understood that no hard and fast separation of the circuits into the different regions can be made. There are exceptions to any general scheme of division which could be laid down. Probably the most accurate statement regarding the location of the various kinds of circuits is that in certain parts of the nervous system certain kinds of circuits predominate. With this understanding the following paragraphs should be read. For the sake of simplicity the exceptions will not be mentioned.

The reflex arcs in the spinal cord. Our chief problem is to understand the relation of the arcs of the three levels to the brain and spinal cord. In order to do this we may begin with the spinal cord, which is simpler and more like the original structure in the lower forms of animals from which man developed. We must think of the body and the spinal cord as divided into sections and of each section of the body as supplied by nerves from the corresponding section of the

spinal cord. The skin of each section is connected through reflex arcs with the muscles of the same section. This is illustrated by the withdrawal of the foot when it is tickled. The different sections are not independent, however, but through the branching of the neurons, the reflex arcs of one section have been connected with those of other sections and with the arcs of higher levels. Thus if one tickles the side of a dog it will respond at first with the reflex act of

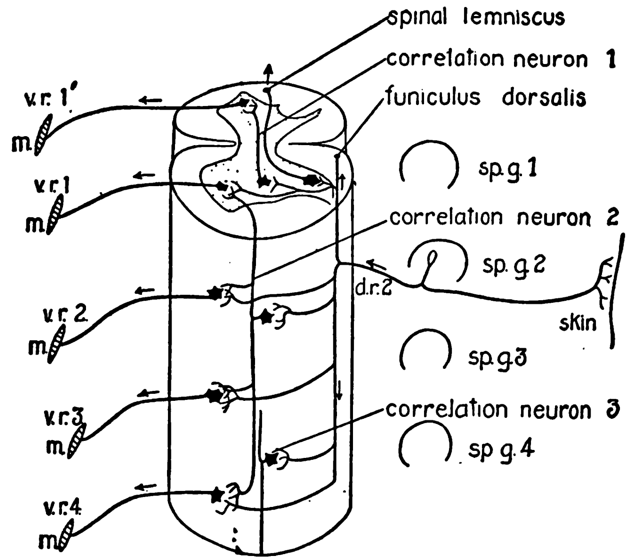

FIG. 6. DIAGRAM OF THE SPINAL CORD REFLEX APPARATUS

Some of the connections of a single afferent neuron from the skin (*d. r. 2*) are indicated: *d. r. 2*, dorsal root from second spinal ganglion; *m.*, muscles; *sp. g. 1* to *sp. g. 4*, spinal ganglia; *v. r. 1* to *v. r. 4*, ventral roots. (From C. J. Herrick's *Introduction to Neurology*, by permission of W. B. Saunders Company.)

scratching with the hind foot, but if this movement does not alleviate the tickling other acts will be resorted to. The arrangement of the reflex arcs in the spinal cord is shown in Figure 6.

The reflex arcs and instinctive centers in the head. Originally the part of the nervous system in the head differed little from the parts in the rest of the body. It contained reflexes from the skin to corresponding muscles. It early acquired importance from the fact that the mouth was located here, and that stimuli in this region regularly set up responses in the body as a whole. It acquired still further importance from the development of the organs of distance sense in the head — smell, hearing, and sight. These senses had their own local reflex responses, as they still have, and the centers for these reflexes are located in the head; but they also served to unite the various parts of the body into unified activity, and as a consequence the head centers came to be the centers for instinctive activity. The part of the brain which contains both the reflex centers of the head, and, for the most part, the centers for instinctive activity, is called the brain stem. This is a general term which covers a variety of organs, but it will suffice for our purpose.

The higher level arcs in the cerebrum. In the higher animals (higher vertebrates) these centers of the brain stem are completely overshadowed — in fact, literally covered over — by the additional development of the higher arcs in the cerebrum. The superimposed neurons which convey incoming impulses upward from the reflex and instinctive circuits, and the neurons which convey corresponding outgoing impulses to these lower circuits, pass into the cerebrum from the center, and thence outward to the outside, where the cell bodies are located. It is possible also that the cerebrum is the organ for some of the instinctive activities. These connections are shown in Figure 7. This outside is gray in color, because of the presence of the cell bodies, and is called the cerebral cortex (literally rind). The inner part, composed of fibers, is white. The cerebrum is divided into two hemi-

spheres, each hemisphere in general being connected with the opposite side of the body. The two hemispheres are intimately connected with each other.

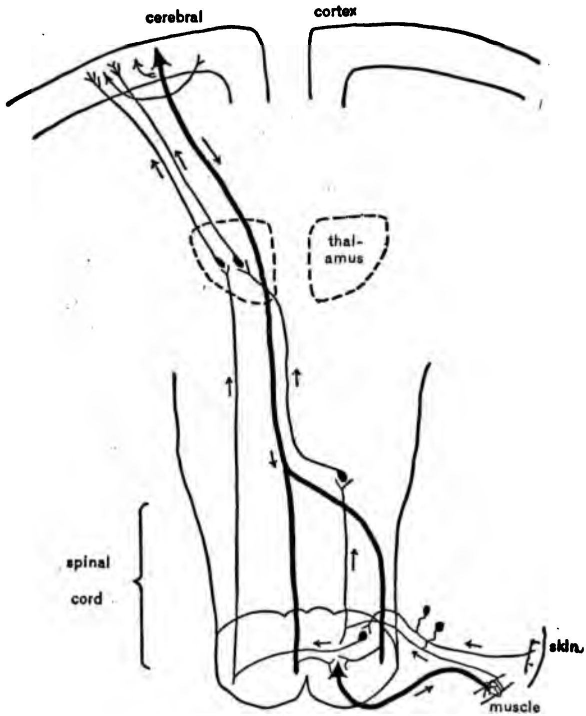

FIG. 7. DIAGRAM OF CERTAIN CONNECTIONS BETWEEN THE SPINAL CORD AND THE CEREBRAL CORTEX

(From C. J. Herrick's *Introduction to Neurology*, by permission of W. B. Saunders Company.)

An additional coördinating center, the cerebellum, unifies the movements of the body as a whole. It appears to have little direct connection with mental activity.

The localization of the arcs of the second level in the cerebrum. In the course of the development of the second level arcs they have become grouped into special areas in the cerebral cortex. There are certain areas to which the sensory nerves come, and others from which motor nerves go. They are called sensory and motor areas. There are not only sensory and motor areas in general, but special areas for each of the senses and for each group of muscles. The localization of the chief areas is shown in Figure 8.

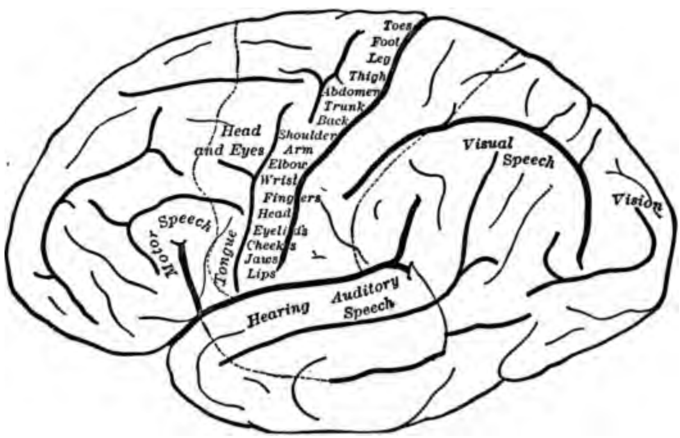

FIG. 8. THE HUMAN CEREBRAL HEMISPHERES SEEN FROM THE LEFT SIDE, UPON WHICH THE FUNCTIONAL AREAS OF THE CORTEX ARE LOCATED

The areas marked "Toes," "Foot," etc., to "Lips," are motor areas. The area back of (to the right of) the motor areas is the area for touch and muscle sense. (From C. J. Herrick's *Introduction to Neurology*, by permission of W. B. Saunders Company.)

The localization of the arcs of the third level. It is evident that the arcs of the third level must be arranged in such a way that they form connections among a great variety of the lower level arcs. We saw that even on the reflex level there were interconnections between different arcs. The action of the third level makes it possible to govern the

response to a stimulus by bringing to bear upon it through association a great variety of experiences and ideas. The neurons of this level, in consequence, are connecting, or associating neurons. Even in the highest of the lower animals the brain is almost entirely made up of sensory and motor areas. This corresponds to the fact that the action of these animals, as for example the monkey, is chiefly on the second level. There is little or none of what we call memory, imagination, association of ideas, reasoning, etc. These forms of mental life, which compose what we call the third level, are based upon the action of another sort of brain area. It will be seen from the figure that the definitely located areas, either sensory or motor, in the human brain, do not by any means exhaust the surface of the brain. There are large areas existing between these. For example, there is a large and unaccounted for space between the auditory and the visual areas, also between the area for vision and the area for movements, and finally the area located in the front part of the brain. These have been called association areas because they do not form the basis for sensations or for movements, but rather for the formations of connections or associations between different sensations, or between combinations of sensation and movement.

Summary. To sum up this description of the nervous system, we may say that it consists partly of series of arcs of simpler nature connecting the sense organs and the muscles directly, and that these arcs are located chiefly in the spinal cord and the brain stem. In the second place, there are, in addition to these simple, direct arcs, other arcs which connect the lower centers with centers of sensation and movement in the brain. These arcs of the second level make possible the formation of complex types of recognition which are called " perception," and the development of new forms of activity which are called " sensori-motor habits." In the

third place, especially in the human being, there is a third level, comprising the association areas of the brain, which make possible not merely a variability in response but the development of ideas and the association of ideas, in such a way as to bring to bear on our responses trains of thought, memories of past experiences, anticipations of future experiences, and the consideration of general principles as governing our actions.

A knowledge of the nervous system gives a concrete basis for understanding mental facts. We have described the general structure and mode of action of the nervous system in order to make it possible to convey an idea of the physical conditions and limitations of mental action. The laws of mental action are probably fundamentally merely laws of nervous action. It is true that in most cases the observation of mental life throws more light upon the activities in the nervous system, than direct observation of the nervous system throws on the laws of mental activity; but a general notion of the structure of the nervous system, which has been developed both from the study of the physical structure itself and an observation of human conduct, enables us to get a concrete idea of the conditions which underlie the laws of mental activity. In other words, this study enables us to visualize the physical facts corresponding to the mental facts, and this visualization of the physical facts serves to make an explanation of the mental facts more concrete than it would otherwise be.

The nervous structure emphasizes the motor side of experience. Besides enabling us to understand better the reason for many of the facts of our mental life, and to give them a systematic and concrete foundation, the conception of the nervous system which has been outlined causes us to take certain general points of view in regard to the principles of mental activity and mental development. In the

first place we are made to see clearly that the nervous system is arranged not merely in such a way that it may receive impressions or be sensitive to stimuli, but that it is equally adjusted to bring about responses to these stimuli. We have a concrete, material basis for the view that was presented in the introductory chapter, and are prepared to recognize that a person's mental attitude toward the world about him depends on the motor expression through which the nervous impulse finds its outlet, as well as upon the impressions which he receives. A child and an adult see a circus parade. The impression in the two cases is the same. But the child reacts by running, jumping, shouting, and keeping time to the music. The adult reacts by noting the animals which are new to him, or by comparing the elaborate circus of the present with the simple affair of his childhood. The different modes of reaction makes the whole experience different.

The three levels emphasize the distinction between different kinds of responses. In the second place the distinction between different levels in the nervous system helps us to classify the different kinds of responses. The child is born with a number of reflex and instinctive responses of the first level. He builds up in the course of his experience many sensori-motor responses of the second level. So far we may compare his development with that of the animal. The dog scratches himself, snaps at objects, swallows food which is in his mouth and chases cats, all as matters of reflex response. He can be taught to "speak," to roll over or to "point" through the development of the sensori-motor responses of the second level. The child, in addition to such acts as these, remembers, imagines, thinks, compares and associates his experiences. In this he employs the third level. The mistake is sometimes made of attempting to describe the whole mental development as though it

were made up of reflexes and sensori-motor responses. We shall see again in the chapter on Transfer of Training how a mistaken idea of the nervous system may lead to this error. The third level is as real a part of the nervous system as are the first levels, and of vastly more importance. It is, however, built on the basis of the lower levels, and it is an equally serious mistake to ignore the importance of reflex and instinctive activity as a basis for the higher mental life.

QUESTIONS AND TOPICS FOR DISCUSSION

1. Find two specific illustrations which show the intimate connection between the nervous system and mental life.
2. Name as many kinds of sensation as you can.
3. Give examples of delayed responses.
4. Illustrate further learning on the sensori-motor level and on the level of ideas in human beings.
5. What is the general significance of the neuron in the nervous system?
6. Through what means do groups of neurons acquire a working relationship to each other?
7. Trace, if you can, the path traversed by the nervous impulse in the reflex turning of the eye to look toward an object at the margin of the field of vision.
8. Look up and describe Broca's area.
9. Locate in a rough drawing of the brain the center in the cerebrum for movements of the right hand.

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CHAPTER III

THE RELATION OF NATIVE AND ACQUIRED RESPONSES

1. The problem

It has been believed by some that education is of chief importance in the child's development. Two extreme views have been held concerning the importance of native responses in comparison with acquired responses. On the one hand, it has been thought that the child is born with a nervous system capable of any sort of development, within the range of human possibilities, which the environment may be fitted to produce in it. This view is that the child possesses a great variety of possibilities, any one of which is equally capable of being fulfilled. As the great English philosopher, John Locke, expressed it, the mind of the child is a blank tablet or *tabula rasa* upon which experience traces its forms. In the first section of his *Some Thoughts on Education* Locke sums up the relative importance of inborn constitution and education as follows: —

> I confess, there are some Men's Constitutions of Body and Mind so vigorous and well framed by Nature, that they need not much Assistance from others; but by the strength of their natural Genius, they are from their Cradles carried toward what is excellent; and by the privilege of their happy Constitutions, are able to do Wonders. But examples of this kind are but few; and I think I may say, that of all the Men we meet with, nine parts of ten are what they are, good or evil, useful or not, by their Education.[1]

The mind of the mature person, according to such a view, is almost entirely a product of the experiences which he has had during his lifetime.

[1] Locke, John. *Some Thoughts on Education*, p. 1. Edited by R. H. Quick. (Cambridge University Press.)

Others have held that the inborn nature is the chief factor in development — Rousseau's view. On the other hand, it is sometimes thought that the child's development is chiefly an unfolding of certain instincts which he possesses at birth, or which develop in him apart from any peculiar experiences which he may have. The child's possibilities are thought of as strictly limited by his inborn capacities. He is supposed to possess certain traits which unfold themselves in a manner which is very little if any influenced by the surroundings in which he may live. If the general trend of the writings of the philosopher Locke may be taken to represent the first extreme, the French philosopher and political writer, Rousseau, may be taken to represent the second point of view.

> If children leaped at a single bound from the state of nurslings to the age of reason, the current education might be the best for them; but in accordance with natural progress they require an education of a totally different sort. They must do nothing with their soul until it has all its faculties; for it is impossible for the soul to perceive the torch which you present to it while it is blind, and to follow in the boundless field of ideas a route which the reason traces so faintly even for the sharpest eyes.
>
> The first education, then, ought to be purely negative. It consists not at all in teaching virtue or truth, but in shielding the heart from vice, and the mind from error. If you could do nothing and allow nothing to be done; if you could bring your pupil sound and robust to the age of twelve years without his being able to distinguish his right hand from his left — from your very first lessons the eyes of his understanding would be open to reason.[1]

Karl Pearson's conclusion from his study of inheritance. Many have been led by the modern scientific study of inheritance to emphasize the importance of inborn capacities. Karl Pearson, who succeeded Sir Francis Galton in this study, states his position emphatically: —

[1] Rousseau, *Emile*, pp. 58, 59. Translated by Paine. (Appleton, 1905.)

We stand, I again feel certain, at the commencement of an epoch which will be marked by a great dearth of ability. The remedy lies beyond the reach of revised educational systems; we have failed to realize that the psychical characters, which are, in the modern struggle of nations, the backbone of a state, are not manufactured by home and school and college; they are bred in the bone. . . . I have striven by a study of the inheritance of the mental and moral characters in man to see how it (ability) arises, and to know the real source of an evil is half-way to finding a remedy. That remedy lies first in getting the intellectual section of our nation to realize that intelligence can be aided and trained, but no training and education can create it. You must breed it. That is the broad result for statecraft which flows from the equality in inheritance of the physical and psychical characters in man.[1]

Our verdict is of practical importance. The practical bearing of this question is well indicated in another passage from Locke. This passage also indicates that in spite of the general trend of his philosophy and the statement which is quoted above, he modified his theory when it came to its practical application.

He therefore that is about children should study their Natures and Aptitudes, and see by often Trials what Turn they easily take, and what becomes them; observe what their native Stock is, how it may be improved, and what it is fit for. He should consider what they want, whether they are capable of having it wrought into them by Industry, and incorporated there by Practice, and whether it be worth while to endeavor it. For in many cases all that we can do, or should aim at, is, to make the best of what Nature has given, to prevent the Vices and Faults to which a Constitution is most inclined, and give it all the Advantages it is capable of.[2]

If education is everything and the differences due to inheritance of no account, then we may hope to produce any

[1] Pearson, K. "On the Inheritance of Mental and Moral Characters in Man"; in *Biometrika*, vol. III, p. 159.

[2] Locke, *op. cit.*, p. 40.

sort of result, of which human nature is capable, with any child. The school would still have to take account of the kind of training the child received in the home, but this might also be directed. If, on the other hand, children differ in native capacity, then it is necessary to find out what these differences are and suit the training to them. This is the practical problem.

Neither extreme is correct. Scientific studies of both animal and human development have shown that neither of these extreme views can be justified. The development of the nervous system and of the mind is always due to certain stimuli which produce responses, but the responses which are made depend upon the native capacities or tendencies of the animal or the person as well as upon the stimuli. The way in which experience may serve to direct or modify the development of the instincts we shall discuss particularly in another place. The question which we have before us here is, to determine to what extent the child's development is limited by his native capacities, or to what extent it depends on the sort of training or education he receives.

2. The evidence for the importance of inborn nature

The evidence from a comparison of primitive with civilized man. One kind of evidence which we may use in attacking this question is derived from an observation of the differences in the responses of persons of different grades of civilization. It was formerly thought that the difference between the savage or the primitive man, and the civilized human person, is chiefly due to an evolution of the physical organism, — that is, to development of a higher type of nervous system. The civilized person was thought of as standing on a higher plane because he had progressed farther in the course of physical evolution. Students of primitive man, however, have come to think that the greater part of the

difference between primitive modes of response and those of civilized communities, can be accounted for by the development of traditions, of institutions, and of ideas and means of expressing and communicating these ideas, rather than by any such physical evolution. If we examine the mental capacity of the so-called savage, we find that it does not differ as greatly as we have been wont to think from that of the civilized person. The chief difference is in the ideas regarding what conduct is right or appropriate, and in the ideas which comprise our science, art, and letters. This comparison rather emphasizes the importance of education and of training as distinguished from physical capacity.

The evidence from individual differences within the same community. Besides these differences between people at different levels of civilization, we find many differences between persons of the same social group. The question still remains, then, What is the chief cause of these differences between persons who have had in the main the same kind of education or training? In the primitive community we find certain persons who are leaders and others who seem able or disposed only to follow the leadership of another. We find some who are capable of innovations of an intellectual sort, while others merely are capable of understanding so much of science as has been developed in the past. We find some who conform to the customs and ideas of morality which are prevalent in the group while others assert their own interests and will in opposition to the group. We might give many other illustrations of differences between persons who are in the same general scale of social development.

Galton's study of English judges gave evidence of the inheritance of intellectual capacity. Let us consider for a moment the sorts of evidence which have been presented to support the view that inborn capacities or traits are

important as a factor in the development of the individual. The English scientist, Sir Francis Galton, studied the biographies of English judges who were on the bench from 1660 to 1885. He found that of the 286 judges, 109 had eminent relatives — an enormously higher percentage than would have been found in the case of 286 persons picked at random. It appeared, further, that by far the greater number of eminent relatives were near relatives — as father, son, or brother. These Galton named relatives of the first degree. There were about one quarter as many eminent relatives of the second degree — uncles, grandfathers, etc. In a word, near relatives of eminent persons have a much greater chance of being eminent than distant relatives. Finally, it was found that more of the judges of the highest eminence, the chancellors, had eminent relatives than the rest, the percentage being 80 and 36 respectively.

Galton's study of twins showed striking similarity due to close relationship. Galton also made a study of persons who are the most closely related of any, namely, twins, in order to see whether their resemblance is due to some capacity or trait which is born in them, or to a similarity of early surroundings. His study was not extremely exact, but it indicated that if twins were alike, a difference of training or surroundings was not likely to modify that similarity. If, on the other hand, they seemed not to be particularly alike in their original nature, they would not grow alike even though they had very similar training.

Woods traced the inheritance of mental and moral traits in royal families. Another study of heredity somewhat similar to Galton's study has been made by F. A. Woods, upon royal families in Europe. Here again a study can readily be made because there are on record biographies of the various European royal personages and their relatives. Woods found that there are different strains among royal families,

and that in some of these strains there is to be found high intellectual ability, and in others a mediocre or low degree of ability. He found also that there are specially pronounced particular traits which may be followed in certain strains. Woods describes a striking case of the transmission of a physical characteristic in the Hapsburg lip. One may observe this feature in photographs of the present King of Spain. It consists of an enlarged lower lip and protruding jaw. This trait can be traced back through eighteen generations to one of the progenitors of the house in the fourteenth century. In a similar manner a strain of insanity was introduced into the same line by Joanna the Mad, and appears in her descendants according to a regular law. In any family among her descendants one can predict roughly how many will be affected by the mental trait by calculating the proportion of its ancestry who inherit her blood.

Davenport and Goddard have made similar studies. A similar study of genealogies among American families has been made by C. B. Davenport, who is able to trace the inheritance of certain traits through many generations. Davenport traces the descendants of a remarkable woman of colonial times named Elizabeth Tuttle. This woman combined extraordinary mental ability with immoral tendencies. She gave rise to two lines of descendants, both of which were remarkable, but in one the immoral trait was present and in the other it was not. The most eminent representative of one line was Jonathan Edwards, and of the other Aaron Burr. Some of the students of the feeble-minded, for example, H. H. Goddard, believe that they can demonstrate that feeble-mindedness is passed from generation to generation by heredity. From a study of 327 family histories of feeble-minded persons, Goddard assigns heredity as the cause in 54 per cent of the cases, and as the probable cause in 11.3 per cent of additional cases. In

another 12 per cent the cause assigned is defective nervous organization in the ancestry, which appears as feeble-mindedness in the offspring. In only 19 per cent of the cases are the causes believed to be accidental.

Eminent families also illustrate inheritance. The way in which eminent mental ability may run in a family is illustrated in the accompanying chart (Figure 9) which represents several generations of the Darwin family, and the related Wedgwood and Galton families. The extraordinarily large proportion of eminent men, represented by black squares, among the descendants of the three eminent men, Josiah Wedgwood, Erasmus Darwin, and Samuel J. Galton, is evident at a glance. If we examine the relatives of Charles R. Darwin, the great student of evolution, we are struck with the eminence of both his ancestors and his descendants.

Studies in school grades bring out differences in native capacity. The notion that a person possesses a certain degree of intellectual capacity, which can be modified by his education only within certain limits, is supported by studies which have recently been made in school grades. W. F. Dearborn and others have shown that a pupil maintains very much the same general rank in the different schools which he attends. If he is at the top of his class in the elementary school, he is likely to remain near the top in the high school and the college. President Lowell of Harvard has shown that this correspondence exists between the standing of students in the college and in the medical school, even though the work taken in the college may be of a classical rather than of a scientific nature.

Special as well as general ability appears to be inherited. There is evidence which leads us to believe that certain particular kinds of ability are inherited or possessed by the person as inborn capacities. There is evidence, for example, that musical ability is something which a person possesses,

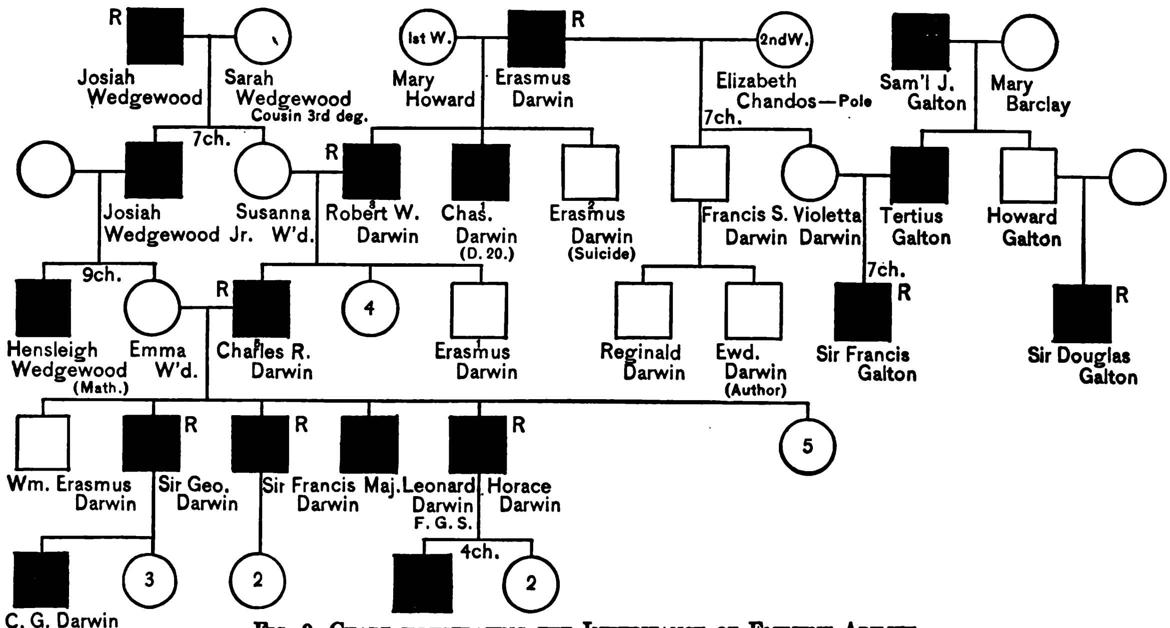

FIG. 9. CHART ILLUSTRATING THE INHERITANCE OF EMINENT ABILITY

(Adapted from Sir Francis Galton's Chart by Dr. E. R. Downing.) Squares represent men and circles women. Blackened squares indicate a high degree of eminence, and the letter R indicates membership in the Royal Society of Great Britain.

and which, although it requires training to develop, yet cannot be created by training. Even a difference in ability in addition, subtraction, multiplication and division, indicating a superiority in one, or an inferiority in another of these operations, may perhaps be traced from parent to child.

Different degrees of capacity are distributed in a regular manner. If these marked differences exist between persons,

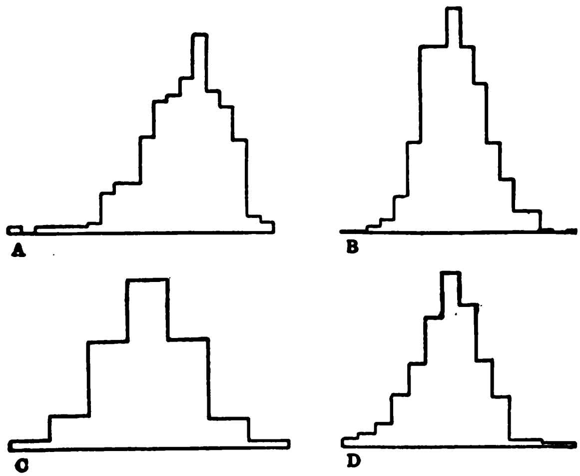

FIG. 10. ACTUAL DISTRIBUTIONS FOUND IN MENTAL MEASUREMENTS

A. Reaction time of college freshmen.
B. Efficiency in marking *A's* on a sheet of printed capitals; twelve-year-old boys.
C. Memory of digits of women students.
D. Efficiency in writing the opposites of words; twelve-year-old boys.

due to their native capacities, the question arises as to how are they distributed among the individuals of the whole population. These differences are sometimes thought of as separating people into several groups, according as they possess a high degree, a medium degree or a low degree of ability. Considerable study has been made, on the basis of

mental tests and of school grades, of the form of this distribution. The general result of the study has been that all of the different degrees of ability between both extremes are represented. It is further found that more individuals appear at the middle point between the extremes than at any other point, and that fewer and fewer persons are found as we progress from the middle point toward either extreme. This means that there are very few persons of either exceptionally good or exceptionally poor ability, but that there are a great many of average or about average ability. An illustration of the way in which different degrees of a trait may be distributed is given in Figure 10, which is taken from Thorndike's *Individuality*. The manner of construction of the charts is described in their titles.

The distribution of capacities should be recognized in school organization and in teaching. This form of distribution of abilities corresponds to the distribution of different degrees of physical traits as, for example, height and weight. It may be used in a practical way in assigning school grades, provided we use a system of relative marks; or in calculating the extent to which any uniform mode of treatment will be likely to suit the different persons of a group. If school grades are so given that half the class receive the highest grade, or a third fail to pass, it is clear that the marks are not so distributed as to correspond with the differences in ability of the pupils. Yet such extremes of these may be found in the marks given by teachers in the same school. If, again, a school system is so arranged that one half the children cannot do the work which is planned and keep up with their grade, while only two or three per cent can do work which is superior to that which is supposed to be suited to the majority of the children, it is evident that the work is not adjusted to suit the ability of the children.

Degrees of ability in different subjects are related. An-

other question which arises, is whether a person is likely to take the same rank in tasks involving the different sorts of mental ability, or whether he is likely to be highly specialized and to stand near the top of the group in some kinds of ability and toward the bottom in others. When we find persons standing in about the same rank in different kinds of ability, we say that there is correlation between these abilities, and when there is no apparent relation in the standings in two kinds of ability, we say there is no correlation. When there is apparent opposition between two sorts of ability, we say there is negative correlation.

There is a higher degree of correlation among some traits than among others. In general, the results of tests have indicated that there is a fairly high degree of correlation between what we call the higher mental traits, such as memory, the ability to make judgments, the ability to reason, and to discriminate between shades of meaning. There does not appear, however, to be a close correlation between these higher mental traits and the simple elementary capacities, such as rapidity of movement, or sensitiveness to differences in sensation. There is low correlation between the standing of pupils in manual training on the one hand, and in English, mathematics, and science on the other, but there is rather a high correlation between the academic subjects themselves. Within certain limits we can predict that if a pupil does well in one subject he will also do well in another, and we know something about what those limits are. We know, for example, that the prediction is a little more certain in the case of very good or very poor pupils than in the case of mediocre ones. This ability to predict the degree of ability a person will be able to attain in a particular kind of work on the basis of his previous achievements may possibly ultimately be developed so as to be useful in guiding a youth to the vocation for which he

is best suited. This will depend on a fuller knowledge of the kind of ability which will be required in the various vocations than we at present possess.

Zeal must be taken into account as well as ability. Although this correlation exists, caution is necessary in interpreting the results of any single test of ability. As James points out,[1] a person's total performance may not be determined merely by his capacity in this or that single mental trait, or even in a combination of intellectual capacities, but also by the enthusiasm and the persistence with which he applies the capacities which he possesses in the pursuit of his desires. We must avoid assuming, because there are fairly definite limits set to individual capacities, that we have discovered what those limits are with reference to any particular person. The result of training a person in any direction will depend in large measure, it is true, upon the ease with which he is able to profit by that training. For example, it is not worth while to give a person who is deficient in musical ability a high degree of musical training. On the other hand, if a person desires very intensely to possess a certain kind of ability, or if this ability is very essential from the point of view of his social usefulness, then a great amount of effort may rightly be expended in giving him the necessary training.

There are native differences in all mental traits. Native differences between persons exist not merely in intellectual capacities, but also in their temperament, their social attitudes, and the character of their reaction on moral questions. We shall see what these differences are when we come to discuss social types, and we shall attempt to determine how far native tendencies in these directions may be modified by education. These temperamental differences and differences in a child's social attitudes have to be taken into account,

[1] James, W. *Talks to Teachers*, p. 113.

as well as his intellectual traits, in determining the vocation for which he is fitted, and his probable success.

3. The importance of education or training

In spite of these forms of evidence that the individual's development is governed largely by the nature which he inherits, we must not conclude that education is of little importance. There is perhaps not so much evidence which has been collected in a rigid and scientific manner on this side of the question. The reason for this probably is that the common belief has been that education is all-powerful. The need was not felt, therefore, for supporting this belief by gathering scientific evidence. Now that the issue has been definitely raised, however, some of the evidence which exists is being carefully weighed and some scientific work is being done in gathering additional evidence.

Many delinquent children are not defective. In recent years, mental and physical tests have been made of many children who have committed offenses against the law and have been brought into the juvenile court. In very many of these cases no inherent defect of either a physical or a mental nature has been discovered. Many of the children are as bright or brighter than the average child. There is some difference of opinion as to the proportion of delinquent children who are defective. Different investigators have arrived at widely divergent conclusions, but it seems clear, as pointed out by Dr. William Healy, of the Chicago Juvenile Court, that the children who are brought into the court are among the duller of those who have committed offenses; and that therefore when we find that a considerable number of them are perfectly normal, we must conclude that a still larger number of all of the children who are delinquent are normal. We must therefore conclude that the offense of many of these children is not due to anything peculiar in

their nature, but to the fact that their ideas or attitudes have been warped by the surroundings in which they have been brought up.

A change of environment regenerates many children of the slums. This evidence, which has been produced by the examination of delinquent children, is backed up by the experience with children who are rescued from their evil surroundings by philanthropic agencies, and placed in institutions or in private homes. Miss Thompson has made a study of the records of several hundred such cases in which the life of each child was followed for five years after having been placed out; and she finds that in the large majority of the cases, when the children have been rescued before twelve years of age, they lived law-abiding, self-supporting lives.

Individual experience gives evidence of the importance of environment. If we examine our own experience, we find evidence that the course of the development of our ideas and sentiments has been influenced very largely by the persons we have met, by the books we have read, and by the beliefs or opinions which are current in the social group in which we move. It is possible in some cases to point to particular sources of influence which have governed much of the course of our thinking or action. The demands which are made upon us by our vocation have a large influence on the course of our development. It is a commonly observed fact that one can often detect in the manner and mode of thought of a person what vocation he pursues. Even one's emotional attitudes depend to some extent upon the character of the persons with whom one is in daily contact.

The child responds differently to different persons. It is a matter of common observation that children differ largely in their mode of response when they are in the presence of different persons. A child is so responsive to his surround-

ings that he may seem to be a different creature when under the control of different persons. We shall see in the chapter on Mental Control that in order to enable children, especially those who are inclined to nervousness, to gain self-command, it is necessary that the persons who surround them be calm and self-controlled. Some children are more seriously affected by unfavorable surroundings than are others. This proves that inborn nature is important. But the same children react differently to persons of different temperament. This proves the importance of surroundings.

The influences of early childhood are the most important. In general, the early period of childhood is the time in which the influences of education and environment are the most important. The accounts which we have of the special training received by a number of men in their early childhood, which produced in them a very unusual degree of early intellectual development, indicate that much more can be done to train the child in the ability to think in the early years than has been commonly supposed. The autobiography of John Stuart Mill illustrates the possibilities of this early training.

Education gives the tools of thinking. It is clear that one's mental development depends on the material and the tools of thought which one gets through education. We know that language is one of the most important of the conditions for thinking. Therefore the type of language which the child learns will be of importance in his development. The knowledge of certain words makes it possible to think the ideas which these words express. The ability to read is a necessary condition of obtaining information and intellectual stimulus from books. Furthermore, the influence of this sort of training upon one's mental development is cumulative. Learning to read does not only give the child a certain amount of intellectual training or information, but it opens

up to him exhaustless fields of information and sources of stimulus to thought and reflection. Every new book which is mastered opens up avenues of thought and makes possible the appreciation of many other books and new systems of thought.

Education affects accomplishment more than capacity. In considering the significance of heredity and environment, we must recognize that the value and significance of a person depends not so much on his ability or his innate capacity as it does upon what he is able to accomplish; and what one can accomplish or achieve, depends not merely on his capacity, but also on the sort of training he receives, which enables him to use his capacity and develop it into useful forms of ability. From the point of view of achievement, as distinguished merely from capacity, the mastery of tools of intellectual activity, and of the use or application of the principles of mental work, is very important. We shall see in the last chapter that there are efficient and inefficient ways of working. One can be taught in a large measure the efficient as distinguished from the inefficient methods. Training, then, may determine to a very great extent whether a person shall accomplish much or little.

Erratic children especially need proper guidance. Training is of especial importance in the case of children of a particular type. Some children have an especial bent or a particular form of capacity in which they are superior. They are of a somewhat nervous or unstable temperament, however, and if they are not properly treated they will develop into one-sided persons who are not able to make practical use of their talent. With a proper education so as to develop somewhat the weak side of their mind and to give proper balance and direction to their efforts, such children may develop into very well-balanced and efficient persons.

Inheritance gives capacity, education develops it. In addition to saying in a general way that a person's development is partly due to his inborn traits and partly to his education or training, it is possible to distinguish the kind of influence which the one or the other factor exerts. We have seen that one's capacity is largely due to his inborn nature. On the other hand, the ideas which the individual has, and which govern the direction in which his capacities will find their development, are largely due to his environment and training. For example, the sensations and images which are parts of the material of thinking come from experience; and the moral standards which a person possesses — the estimate of things as being worth while or trivial — will be largely adopted from the beliefs and attitudes of his associates. The direction in which a person's capacities will be applied is fully as important as the degree of those capacities themselves. It is a trite saying that the development of extraordinary mental abilities is of no value if a person exercises them in a baneful direction. Therefore we must conclude that education, in determining the kind of training which the child should receive, must take account of his inborn capacities and traits; but in calculating what the final result of his development is to be, it must take account also of the influence both of his formal education and of the experience which he gains in his life outside of the school.

QUESTIONS AND TOPICS FOR DISCUSSION

1. Give some definite, practical illustration of a case in which one's view regarding the issue of the chapter would be important.
2. Mention some differences among people whom you have met, which are like the differences between primitive and civilized persons, though less in degree, and which are due to differences in education.
3. Describe any striking instances of family resemblances which you may have observed.
4. Why does the likeness between twins have a bearing on the chapter?
5. Mention several capacities which are necessary to musical talent.

6. Make a distribution chart to represent the following grades, given to a class of students. C, B, E, A, C, D, C, B, C, D, B, B, D, C, C, C, B, C, E, C, D, D, C, B, B, B, C, D, C, C, D, B, C, D, C, B, C, A, D, C, C, D, C, C.
7. Give instances you have met of a change in a person produced by a change of environment.
8. Give further specific illustrations of the office of education in giving the tools of thinking.
9. Illustrate further the effect of education on accomplishment as compared with capacity.

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CHAPTER IV

THE CHILD'S NATIVE RESPONSES: PLAY

In order that the education of the child may be effective it must suit his capacities as determined by the traits common to humanity, by his own peculiar traits, and by the stage of development which he has reached. A full discussion of these matters would form the subject of a book on child-study. We can only summarize the most important facts in the next four chapters, and refer the reader for a fuller account to a book on that special subject. In these chapters we shall describe some of the more important native responses of the child. We shall not attempt to make a full catalogue of his native responses, but only to select such for brief treatment as seem to be of greatest practical significance. In a following chapter we shall treat some of the more general problems of the child's development.

1. *The instincts and their importance*

The use of the term "instinct." Native or instinctive responses are sometimes interpreted in a narrow sense to mean only very definite kinds of movements, which the person is capable of making without learning, and which he makes more or less invariably in response to certain kinds of stimuli. The term "instinct," however, may also be applied to those more general impulses or interests which are embodied now in one and now in another specific form of movement. Thus we may catalogue curiosity among the instincts, although it is expressed in a great variety of forms of response. It may cause the child to handle an object, or to attempt to take it to pieces in order to see how it is con-

structed. It may be expressed in walking to some object which has excited interest; or, in an older person, it may be satisfied by reading or gaining information from a book. It is in this sense that we here employ the expression "native or instinctive response." In many cases these native responses are expressed in certain definite forms, but in others the form of expression varies widely. The more definite and fixed forms of response are to be thought of as based on the activity of the lower level in the nervous system. The development out of these simple activities of the broader interests, purposes, and aims, which demand new and varied activities for their satisfaction, is due to the higher level activities.

The human being has the instincts necessary to preserve life. The human being, in common with animals, possesses certain fundamental and simple forms of instinctive activity, which serve to maintain the individual's physical existence or the existence of the race. The important fundamental instincts are connected with food-getting, the avoidance of enemies, the relation between the sexes, and the home-building and parental activities. Objection is sometimes made to classifying the instincts in this way according to the results which are obtained by their operation, and the attempt is made to observe and catalogue all the detailed responses which are made to particular objects. The propriety of classifying together all the varieties of activities which attain a common end rests partly upon the fact that it is convenient to regard an individual from the point of view of the means by which he maintains his existence, and partly upon the fact that the various responses which attain a certain end come to be classed together more or less closely in the mind of the person who acts, when he becomes conscious of the goal which is unconsciously aimed at in the simple, mechanical, instinctive responses, and more or less

clearly adopts aims about which are grouped a great variety of activities which are not in themselves instinctive.

The satisfaction of these instincts is attained through activities which demand higher mental development. The fact that the human being has these instincts in common with the lower animals does not mean that they serve merely the purpose which is their primary reason for existence. The food-getting activity is not merely, as in the case of animals, represented by a few definite acts. In the human being the acts by which the infant gets its food are simply the starting point of his food-getting activities. These are simple lower-level activities. The animal in large measure continues to get his food in such definite instinctive ways, as in stalking, seizing, and devouring his victim. But in the child food-getting ultimately develops into a host of new and varied kinds of activity. These activities make up our agriculture, and much of our commerce, trade, and professional life. They are higher level responses. Thus the fundamental instincts, originally represented by a few definite, instinctive activities, taking place largely through the action of the lower level of the nervous system, develop into recognized needs which are satisfied through complex and varied occupations, the learning of which employs the higher levels.

The higher development is stimulated by certain less definite instinctive impulses. Childhood is the period during which the development of these higher activities that serve the fundamental needs takes place. This development is brought about by the instrumentality of other activities, or impulses to activity, which are native to the child, and yet which for the most part are less definite and fixed than the primary instincts. These activities are play, including manipulation, curiosity, and the social responses. It is largely through the play activities, through imitation and

through competition, social coöperation, etc., that the child gets the experience and the training which enable him to get his living through the less direct methods than those which are represented in his fundamental instincts. Just how we should place these secondary instinctive activities in the nervous system is not certain. They are represented by much less definite activities than the more fundamental instincts, and probably take place partly on the level of the cerebrum.

These indefinite impulses also satisfy other than life needs. These less definite responses not only serve to develop in the child those habits by which he will be enabled to satisfy his fundamental instincts in human ways, but they also lead to the development of aims and interests which do not serve these fundamental instincts directly, but which are valued for their own sake. In this way are produced our literature, science, and art. These more distinctly human activities were not developed primarily from the impulse to gain a living or to avoid destruction. They grew up along with play, when the pressure of physical needs was lessened by the development of more efficient ways of meeting them.

The less definite instincts are largely social. Two types of native and instinctive activities or impulses have been distinguished. First, there are the very definite sets of activities, which are primarily chains of reflexes, and which serve the more immediate physical needs. Second, there are the less definite types of activity or attitude which serve as the motive power for the development in the child of new ways, not provided by instincts, for meeting his life needs, and which stimulate the development of other human activities that satisfy the intellectual and æsthetic interests. We may further describe this less definite type of native responses by saying that they are in the main social in character. It is through imitation, the stimulus and means

to communication which is furnished by language, the desire for the approval of others and the impetus which comes from competition with them, and the like, that these higher activities are fostered. Manipulation and curiosity are more individual than the rest, but even these are greatly influenced by the social group. The family is the first great social group in which the child gains the human activities. The school comes next in order; and finally he finds himself in the larger community and comes under its influences.

Both sets of activities must be recognized in the school and college. In directing the child's education we must recognize both these sets of responses. After the child has emerged from babyhood, the secondary impulses, such as play, imitation, and curiosity, form his chief motive to action. His immediate life needs are provided by his parents, and with these he is not concerned. These secondary impulses can be utilized to develop in him certain forms of knowledge and skill which will enable him to gain his livelihood when he is thrown on his own resources. But it is a mistake to think that the child must see the purpose and value of the things he learns. The social impulse, the artistic and intellectual impulses, and the pleasure in successful achievement — particularly if it has the approval of his associates — these furnish the chief driving power. But with the dawn of youth he begins to feel the desire to make his own way in the world, — to support himself and to create a home. Now he begins to look forward, and wishes to see some connection between his schooling and a future vocation. Play and the other secondary activities have their place, intensified by the group spirit, but not the whole place. At this stage it is a mistake to ignore this strong vocational impulse and to attempt to carry on high-school and college work simply from motives of culture. The student should now begin to lay his plans for preparation

for his life work, and to arrange his school activities with a purpose in mind. The fulfillment of the purpose may be remote, and the purpose may change, but it will give a stability and earnestness to the work of these years that is very likely otherwise to be lacking.

2. Meaning and value of play

The child's play is less fixed than the animal's. A fundamental impulse which the child has in common with the lower animals is play.[1] Much study has been made of the play of animals and of children, in order to find out what they have in common. These studies have shown that the play of children is very much more varied in its form of expression and very much broader in its meaning and results than is the play of animals. The play of animals is chiefly practice in the development of the instincts which will be useful to the animal in its adult life. In the case of the child, play is to a much greater extent the development of general capacities and powers, which give the child a preparation for a great variety of activities. Thus the special kinds of play which the child carries on are due more to the tradition which is passed down from one generation to another than to any definite instincts.

Play is not of immediate practical use. If we look on play from the point of view of its usefulness in maintaining the life of the animal, that is, from the biological point of view, we find that its aim is not the satisfaction of an immediate need, but rather the development of the animal in anticipation of its future needs. In this it is distinguished from those instincts which lead to the getting of food, or the

[1] Play is an activity which, from the point of view of the observer, meets no need except that of development; and from the point of view of the one who plays, is carried on entirely for its own sake and not for the sake of the results.

avoidance of enemies, or the other more fundamental instincts. In accordance with this biological nature of play, the aim which the animal or the human individual has in carrying it on is different from that which is present with the more immediately useful kinds of conduct. Play is carried on for its own sake rather than to serve as a means for gaining something else. In this, play differs from work, which is carried on for the sake of gaining a reward aside from the pleasure in the activity itself.

The play attitude gradually merges into the work attitude. This play attitude, in which the person is absorbed in the thing which he is doing instead of in its results, is the dominant attitude of the young child. It is difficult to get the child to do anything unless it is interesting in itself. He cannot keep his mind for a considerable length of time upon an activity which is uninteresting in itself, because it will bring him a pleasant experience later on. This play attitude does not break off sharply and give way to the work attitude. On the contrary, it passes gradually over into the other attitude of mind. The child in his play has occasion to do things which have their place in the game as a whole, but which would not be done merely for their own sake. He thus learns gradually to see that the doing of certain things, while not in themselves of interest, is necessary to accomplish his whole purpose. This adoption of the view that certain kinds of activity are related to our wider aims, and the acquirement of a readiness to perform them because they are a part of a broader purpose, is the means by which the child learns to merge the play attitude into the work [1] attitude.

Drudgery, as distinguished from work, is without an aim

[1] Work is activity, whether pleasurable or not, which is carried on primarily to attain some desired end. Drudgery is work without a clear idea of a result to be reached or an interest in it.

which gives the activity meaning. We must distinguish between an act which is work and one which is regarded as drudgery. In both cases the chief stimulus to the activity is some end or motive outside itself; but in the case of work the activity is recognized to be a means to some result which we desire to accomplish, while in the case of drudgery, it is something which merely has to be got through with. Drudgery, then, is work done in an attitude of mind which is produced when one is forced to perform something of which he cannot see the purpose or the aim. When work is done to attain a result in which the worker is interested, the work itself acquires a meaning and interest. When work is performed simply from compulsion it is liable to become increasingly distasteful. The development of the work attitude instead of the attitude of drudgery is accomplished by accustoming the child to hold in mind gradually more remote objects or aims, while still retaining his interest in the immediate activity because it is a means to the accomplishment of his purpose.

The doctrine of play, or of interest, has been adversely criticized. This account of the meaning of play suggests the doctrine that the work of the school should be so conducted that the child will be interested in it; because it is clear that being interested is very much the same as having the play attitude. There is no doubt that there was much room for criticism in the older school because it made no appeal to the interests of the child. On the contrary, the teacher demanded that he perform his tasks regardless of whether he cared anything about them or not; and it was supposed that he was gaining the most important kind of mental discipline from the effort which he expended in doing that in which he was not interested. To conduct the work of the school so that it should appeal to the child was branded "soft pedagogy," which, it was argued, would develop

moral and intellectual weaklings. On the other hand, the opponents of this doctrine of effort pointed out that neither the child nor the adult really puts forth his full effort when he is acting from compulsion, but only when he is interested in his task. Under such circumstances one only gives so much of his attention as is absolutely necessary, and therefore gains neither intellectual nor moral discipline.

The solution of the conflict between the doctrines of interest and of effort. We see from the above account of the matter that the conflict between the doctrine of interest[1] and the doctrine of effort may be solved. The child should not be encouraged, on the one hand, to act merely when the thing of the moment appeals to him. This is the extreme form of the application of the doctrine of interest in which the child adopts wholly the play attitude. Yet a person does not naturally expend effort unless he sees the purpose of what he is doing or sees how it is related to something which he desires. When we attempt to arouse in the child effort without any purpose, we are in reality using as a motive the fear of punishment or of disapprobation, or of other unpleasant consequences, which is entirely extraneous to the thing which he is doing. The only proper solution of the problem is one in which interest and effort are both included, and in which their proper relation is kept. Interest should be of such a nature that the child's effort is called out in prosecuting it to its conclusion. Effort should be expended, in the main, in carrying on an activity which possesses a positive interest for the child instead of merely for the sake of avoiding something which is unpleasant.

Play is not the chief guide in determining what the child's

[1] Interest is an attitude of mind toward a course of action or an object in which one is impelled from within to carry on the action, or to give attention to, examine, handle, approach or in other ways act toward the object; and in which the satisfaction of this impulse gives pleasure.

education should be. Play should not be the only form of activity or the chief form of activity in the child's education, but should rather be employed as one among several forms, all of which are necessary for complete education. To a limited extent the play impulses of the child may serve as a guide in determining what kind of activities are good for his general development. To a large extent the play impulse may be employed for the purpose of awakening in the child a motive to an activity which the school and society have determined to be for his best present or future interests to perform. There are many things which the child must learn in order to prepare him for the life which he shall live when he has grown up. Play may be used in teaching him these things, but the play impulse does not furnish a guide as to what they are. In brief, play is a valuable instrument in education but does not give the means of determining what the content or aim of education should be.

Play as a means of drill, and spontaneous plays and games, should both be employed. Play may be used in the school in two ways. As has been suggested, the child's play interests may be used to lead him to a repetition of the acts which will fix them either as habits of movement or of thought, — that is, play is useful as a means of making drill interesting.[1] On the other hand, the spontaneous play of the child or the organized form of play which is a later outgrowth of his simple, spontaneous play, should be fostered as an important means of general development. The games which the child carries on in the playground, or the social forms of amusement, are not to be regarded only as concessions to his desire for relaxation. They should be consciously adopted by the school as an important means to

[1] Drill consists in repeating an activity, not for the sake of understanding, but to increase one's facility or skill, or to fix associations in the memory.

his social and physical development. Association in games is one of the best means of educating the child in dealing harmoniously with other people; and it has come to be recognized that the vigorous and pleasurable movements of the body in play are the best means of physical development.

In directing the child's spontaneous plays or games it is necessary to know how his play interests or his capacity for different kinds of play change with age. We shall, therefore, describe the kinds of play which are suited to the child in the different periods of his life.

3. Changes with age in play

Play in infancy. In the period of infancy, during the first two years of life, the child's play is chiefly of three sorts: making movements for the pleasure of making the movement itself, seeking stimulation through sensations, and producing effects through handling objects.

Movement play in infancy. Making movements is one of the most pleasurable forms of experience for the infant. He makes a great variety of spontaneous movements, such as waving his arms and legs, swaying his body, and rolling about; and he also greatly enjoys making the more organized movements by which he gains control over his body. He learns in this way to balance his body in sitting, in standing, and finally in walking, running, and climbing. Gaining a mastery over these forms of movement is rightly to be regarded as play because the child's aim is the movement itself, and his satisfaction is the pleasure he gains from making it. As soon as the child has gained sufficient control to enable him to use these movements to gain other ends, such as walking to get some object, the activity ceases to be play.

The infant takes great pleasure in sensations. The infant is also tremendously interested in all sorts of intense sensa-

tions. He enjoys bright colors, loud sounds, sensations which he gets through handling objects, etc. The propensity of the child to carry objects to his mouth is probably due to this pleasure in touching objects. The lips are the most sensitive to touch of any part of the body, and the child, by carrying objects to his lips, gets a fuller experience of them than when he merely touches them with his hands. The great and universal attraction which the rattle has for infants is explained by the fact that it involves both these forms of play. The child, in shaking the rattle, makes vigorous movements, and at the same time gets sensations of sight, of sound, and of touch.

The infant's play with objects consists in "hustling things about." In addition to making movements and gaining sensations the child also greatly enjoys producing such effects with objects as shall give him a sense of power or of accomplishment. This is undoubtedly a fundamental source of satisfaction, which serves to explain and to bring together into the same class a great variety of actions. It explains the interest which we have in all those kinds of constructive activity in which we are reasonably successful, because by them we produce effects which are evident to us, and which display in some concrete form the results of our effort. The earliest form of this general kind of activity has usually not been classed with construction, but it is evidently based on the same kind of satisfaction. This very simple form of dealing with objects is called by Groos "hustling things about," because it consists merely in moving things from one place to another. The child runs through the house and tears up rugs, or pulls the books off the table, or in any way makes a change in the location of objects. This is his means of producing an effect, and it undoubtedly gives him a pleasurable feeling of power.

The next stage of play with objects is destruction. The

next stage is one in which the effect produced is still more striking. This form of play has been contrasted with constructive activity and has been called "destruction." As a matter of fact, destruction and construction, while different in their results, are probably alike in their motive. Some of the child's destruction is undoubtedly due to curiosity — he wishes to see the wheels go round, or to see how a thing is made. Much of it is probably due to the fact that he is not yet capable of building up things, and so he resorts to the simpler operation of tearing down.

Simple dramatic play begins in infancy. In addition to these three chief forms of play, there are some slight beginnings of dramatic or make-believe play in this period. The child will put on a hat and say he is going to the store, or take his father's walking-stick and pretend that he is out walking. This play is always very simple.

The infant's play is not social. In this period there is very little social play. The infant plays largely by himself because he has not yet reached sufficient mental development to be able to play with others. He enjoys older persons as companions, to be sure, so that they may form an audience for his play, or may help him; but he is not capable of any coöperation. If a companion is doing something which is interesting, the infant wishes to do the same thing. He has not sufficient self-control to suffer a division of the rôles in the game, and to take only a particular share for himself.

The play of early childhood. In early childhood, from about two until eight years of age, the child retains his enjoyment in some of the same sorts of play as were carried on in the first period, but his activities become more complex. For instance, his movements are intensified by the use of apparatus such as the swing, the giant-stride, the seesaw, or the rocking-horse.

Play with objects develops into simple kinds of construc-

tion. The early form of construction is one in which objects are combined in simple ways as in play with blocks. After he has acquired a little skill, the child may do the more difficult things, such as cutting out paper and nailing and pasting objects together. In the constructive play of this period the child wishes to make something which has a meaning. The child is neither interested in the perfection of skill or technique, nor in making objects which are so well constructed that they will work, or be of practical use. He is satisfied if the thing can be recognized as the thing he intended, and may stand as a symbol for it.

The most radical development in this period is the growth of dramatic play. The child of this period is continually making-believe that he is somebody else, and the objects about him fit into the drama which he is enacting. The common games of young children illustrate this attitude of mind. Observers have recorded the fact that boys play such games as Indian, policeman, soldier, motorman, or postman. In this play the boy lives through the life of the men whose activity he observes or hears about, and whose activities he can comprehend. The girl at this age plays house or school, or plays with dolls. She also lives through the life of older people who carry on activities which are appropriate to her. The difference between the play of boys and girls at this period is probably not chiefly an expression of a difference in their natures, but is one which they are led to adopt through convention. If boys are not discouraged, they often play with dolls until they are six or seven years of age. Ordinarily the conversation and the influence of older persons directs their attention toward the occupations of men, and the attention of girls toward the occupations of women.

Play is social but not coöperative. Play in this period is carried on with others, and so is social, but is not, except to

a very slight extent, coöperative. Each child wishes to do the most interesting thing or wishes to do the same thing which others are doing. There may be a change through taking turns, but ordinarily each one is in competition individually for the most desirable part in the game.

Play of later childhood: at about eight years the make-believe attitude wanes. In the period of later childhood, from about eight to twelve, the child changes from the make-believe attitude to a more matter-of-fact attitude of mind, and this is very clearly brought out in his play. If one observes the child of the previous period, one will see that he is almost continually living through some kind of drama. He seems very much of the time to be in a sort of dream world, and it is difficult to recall him to the matter-of-fact needs and demands of the world about him. He is satisfied by the things which he can do in this imaginary world, and does not feel keenly his deficiency in dealing with the real world.

The transition appears in drawing, movement play, and constructive activities. Observers have pointed out that at about this period the child awakens to a realization of the inadequacy of his make-believe view. He recognizes in his drawing, for example, that the highly symbolic figures which represent various objects, such as a house or a man, have very little resemblance to the things which they stand for. He recognizes, further, that the things which he constructs could not be actually used to serve practical needs. He therefore develops an interest in gaining such a mastery or control as will enable him to deal effectively with the actual facts of the world about him. He becomes interested, for instance, not merely in making movements, but in developing skill of movement, or strength, or speed. He measures his movements, as when he attempts to jump certain distances, or certain heights, or to run with a certain speed.

He becomes interested in mechanical contrivances and in knowing how they work so that he can understand or make them. There is a development of his constructive interest and ability.

The puzzle interest culminates in this period. The child develops during this period an interest in testing his mental powers also, not for the purpose of accomplishing some outward result, but for the purpose of displaying his skill. This sort of interest is aroused in solving puzzles, and it has been found that the interest in puzzles reaches its culmination at about the twelfth year. This fact leads to a comment on the well-known view that the child is not capable of anything in the way of reasoning or thinking except of a routine sort. His education, it is said, should consist merely in memorizing and drill, — that is, in the development of non-rational habits. If this type of education is given, it may discourage the development of an interest in intellectual activity, but there is ample evidence that the interest exists. This interest should be encouraged so that it has an opportunity for expression in the child's work in school as well as in his outside activities.

Individual competition is prominent. The interest in the development of skill finds its expression in the enjoyment of competition between pairs. The pleasure in learning to make movements skillfully and rapidly is enhanced by the pleasure of making them more skillfully and more rapidly than some one else. The boy keeps a definite record of his achievements to compare it with the record of others, and also to compare it with his own past record. This interest in definite accomplishment should be used more largely than it is in encouraging the child to gain a mastery over the problems in school. This may be done by making careful tests, as in arithmetic, handwriting, or spelling, and by stimulating the child continually to improve his record.

Simple drama may be written and played. Dramatic play, while it is not carried on so spontaneously as in the earlier period, and although it does not dominate the child's whole mental attitude, may still be enjoyed; and because of the child's greater mental development, it may be carried on in a more highly organized form. The child in this period may participate in both the production and the representation of simple drama. He is particularly capable of this kind of representation because he is not yet sufficiently self-conscious to make it difficult for him to appear before others.

There is simple coöperation. There is some coöperation in the play of this period, but it is of a rather loosely organized form. It is incorrect to say, in this as in other matters, that the child develops an entirely new form of activity at a certain definite period. We shall find that at adolescence the most prominent form of development is in socially organized play. This development is anticipated, however, by play in groups during later childhood.

Play of adolescence: competition is intense and is governed by rules. In the adolescent[1] period from twelve to maturity, as in the two previous periods, the kinds of play which characterize the child persist; but certain of them are more highly developed, and certain kinds are emphasized more than others. Individual competition continues and becomes very intense. This is illustrated in boxing, wrestling, fencing, and in more elaborate games, such as tennis. These games also illustrate another feature of the play of this period, namely, that it is characterized by complex rules. These rules govern every phase of the game, and are strictly adhered to. The younger child in his games makes

[1] Adolescence is the period of youth. It is the time when the body attains its maturity, and is marked by the maturing of the social and sex instincts. The time of beginning varies widely, but is usually about eleven years for girls and thirteen years for boys.

his rules as he goes along, or may break them if he can gain the consent of his comrades; but the youth has a keener sense of law and of the necessity of conforming to it.

Constructive and dramatic play are modified. The constructive and mechanical forms of play also develop and become connected with more serious purposes, so that they are not merely forms of play but may be carried on with a vocational motive. The interest becomes more continuous and may be given to a project requiring a longer time for its completion. Dramatic performance becomes for a time more difficult on account of the increase of self-consciousness.

The social games are highly organized. The most significant and characteristic form of development in play during adolescence is the growth of group games. In a group game the interest in individual success or the display of individual prowess is overshadowed by the desire for the success of the team. The pleasure of succeeding is enhanced by the fact that it is accompanied not merely by one's own self-approbation, but also by the approbation of the group to which one belongs. There is also the feeling of loyalty to the group as a result of which the individual gains pleasure from the success of the team without regard to his personal success. This group loyalty is expressed in subordination to a leader. The leader represents the interests of the group, and is a leader by virtue of the fact that he can promote the success of the group as a whole. Subordination to the will of the leader, as representing the whole group, may go so far as to lead to sacrifice of one's individual success in the game. This is illustrated by the well-known play in baseball called a sacrifice hit. In this play the batter hits the ball in such a way that he is likely to be put out, but so that the runner on the base will be advanced toward the home plate, and the likelihood of the side's making a score will be increased. The same self-subordination is illustrated in football, in

which only a few members of the team run with the ball, although other players may do equally important service in opening a way for the runner, or in protecting him from being tackled.

Group loyalty is valuable, but may be narrow. This development of group loyalty is the foundation of social consciousness which causes the individual to identify his interests with those of the group to which he belongs. It may, it is true, be accompanied by antagonism to other groups with which one's own group comes into competition. It may thus be narrow and partisan, and do harm by the fact that it creates division in the larger community. If the development of group loyalty remains narrow in its scope, it may develop into the spirit of caste, or the exaggerated spirit of nationality, of which we frequently see evidence. The difficulty, however, is not in the spirit of loyalty itself but in the fact that it has been too narrowly applied, and the remedy is to extend it by coöperation with wider and wider groups.

Group games involve specialization. In group games the efficiency of each player is increased by specialization, and by careful and extended training for the performance of his special part. The child takes with equal readiness different parts in the game; but the youth, by taking the part for which he is best fitted, gives the best services of which he is capable. The rules which govern such groups are complex and rigid, as in the case of games involving individual competition which have been mentioned.

The changed relation between boys and girls appears in play. In the earlier periods boys and girls either play together on the same footing, or boys play by themselves and girls by themselves, because of their different interests. In the games of adolescence there is another relationship which develops, due to the fact that the boys in their games are

conscious of the approval and favor of the girls who are the spectators of their combats. This introduces an element into play due to the growing difference between the sexes, and to their changed attitude toward each other. There are other games, such as dancing, in which the relationship between boys and girls as members of the opposite sex is one of the chief elements. This form of play appears prominently in the latter part of the adolescent period.

Intellectual competition is carried on. There also develops in the latter part of this period an interest in combat which is intellectual in its nature rather than physical, — that is, debating. The interest in debating is not so intense as the interest in the more vigorous forms of physical play, but by encouragement it may develop and lead to the awakening and strengthening of the interest in intellectual pursuits. Debate, to be of value in the development of intellectual sincerity, should be the expression of genuine conviction on the part of the participants, and not, as is too often the case, mere intellectual juggling.

Intellectual competition between classes gives wholesome stimulus. This interest in intellectual competition may be applied to very good advantage by introducing rivalry between classes or sections of classes. In class competition there is much less danger of the growth of the feeling of personal animosity that frequently accompanies individual rivalry. Furthermore, the task can be better suited to the individual ability of each member of the class, and each may contribute to the success of the group according to his ability. In individual competition, if one of the rivals is inferior to the other he is beaten before he begins, because of his handicap. Group competition also encourages group loyalty, which has already been described. It is therefore desirable to take advantage of this coöperative spirit in intellectual work, as in the youth's spontaneous games.

Group feeling in general is characteristic of the youth. In general, we have seen that the play during adolescence is modified largely by the new social feelings which develop at this time. The youth feels himself to exist in a community with others. He feels that his interests are bound up in their interests, and that his welfare is to be worked out by bringing about the welfare of the whole group. This sense of solidarity is perhaps greater at this period even than it will be in adulthood. The adult develops interests which are connected with his family and the necessity of maintaining its welfare. These cares and interests in a measure separate him from others through the competition which is stimulated by them. The youth does not feel the responsibility for these matters, and therefore there is greater opportunity for the development and expression of group feelings.

QUESTIONS AND TOPICS FOR DISCUSSION

1. Is the statement that the work of the school should be made to meet some need of the child equivalent to the doctrine that the work of the school should be given direct *practical* meaning? Support your answer.
2. What is the relation between play and recreation? Between play and amusement?
3. Give illustrations of what you would regard as opposite errors with reference to interest.
4. What can be done to aid the infant in his play?
5. Mention kindergarten and primary games that are in accord with the nature of the play impulse of this period.
6. Mention any changes in school demands or activities in the intermediate grades which take account of the matter-of-fact attitude.
7. What is the bearing of the youth's disposition toward group action and his group loyalty on the problem of the high school fraternity?
8. What are the dangers connected with school teams and contests between teams? Interschool debating?

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CHAPTER V

IMITATION AND SELF-ASSERTION

1. *The social attitudes*

WE have already found it necessary in the chapter on "Play" to make many comments upon the influence of other persons on the child's attitudes and activities. In most of the child's play, what he does, or the manner in which he does it, or the motives which impel him to act, come from the presence of other persons or his thought of other persons. It is possible to find illustrations of most of the phases of the child's social development from his play life. Many of these have been remarked upon incidentally. It will be the mission of the next chapters to describe the child's feelings toward other persons and the influence of other persons upon him in a more systematic way. Some of the attitudes which will be described are not confined solely to other persons, but they all take place most commonly in relation to others, or grow out of the child's consciousness of himself, which has been developed through his reactions to others and others' reactions toward him.

Imitation is very prominent in the child's activities. The observer of the child cannot fail to note frequent instances of imitation very early in his life. The little boy likes to take his father's hat and cane and pretend that he is going for a walk. The little girl will have a bit of cloth and a needle and thread, and at least go through the general motions of sewing. The child sees his father reading a newspaper and he must have one to read too, although for a time he is as well satisfied when the paper is upside down as when it is right side up. The imitation, in such a case, is of a merely

external sort, but it paves the way for a real imitation as the child's development makes it possible. The child's speech gives continual illustration of his disposition to imitate. He first imitates merely the general intonation and sequence of sounds. Later he imitates the sounds of words quite precisely. It is only through the process of imitation that the child who is brought up in one country learns the speech which is spoken by the people of that land, rather than the speech of other peoples. As the child grows into the youth still other forms of imitation appear. He imitates the dress and the manner, and even, we may say, the standards and the ideas of the society about him.

Imitation conserves social progress. If we look at the matter broadly we can see how this tendency of the individual child to duplicate the actions and attitudes of people about him is one of the most prominent means by which groups of people develop and maintain certain modes of living. The child of the American Indian learned to hunt and fish, to endure great physical hardship, to fight and revenge himself of wrong, and to live a roving life. The child of the white man, who displaced the Indian, learned to read and write, to coöperate with his fellows in making elaborate laws, and to maintain such institutions as the school, the court, the legislature, and the church. He learned the art of tilling the ground and of simple manufacture. In the external mode of life, and in the idea of what was right or wrong, or what is to be admired or to be despised, the child of the white man became very different from the child of the Indian. But it is only to a minor degree that we can account for these differences by any inborn or native characteristics. They are differences of up-bringing or training, and the factor which produced these differences was the disposition of each child to imitate the mode of life which he saw going on about him.

Imitation describes the child's attitude as well as his actions. It is entirely clear that the child is stimulated to do such things because he observes other people doing these things. We might account for this fact without supposing that the child wished primarily to copy others. It has been supposed by some that the child's sole desire was to find out more about the actions which he saw others performing by performing them himself, and so getting them in a more direct way into his own experience. That is, we may think of the child's attitude of mind as something like this: "That thing which that person is doing looks very interesting; I wonder what it feels like to do that. I think I shall find out by doing it myself." No doubt this attitude of mere curiosity is responsible for a good part of the child's imitation, — or possibly most of it. It seems very likely, however, that the child is also impelled to imitate by a general desire to participate in the life about him. If we may read into the child's experience the experience of older persons in this matter, it seems unquestionable that he likes to feel himself to be a member of the group, and that he gets this feeling by acting like others of the group. It gives one a feeling of uneasiness to act in a radically different way from one's companions. This indicates a very strong impulse to conformity on the part of human beings. Why then should we not suppose that the child gets satisfaction from those actions in which he conforms to the mode of life of people about him? In fact, it seems very plausible to suppose that this motive is strong in the child in proportion as his definite instincts are inadequate to give him the training necessary as a preparation for his later life. The willingness of the child to go to school and to acquire the social arts must be ascribed to his desire to adopt the activities of other people.

Emotions are communicated through reflex imitation. There are certain forms of imitation which the child has in

common with many of the lower animals. The chicken can communicate to other chickens the attitude of fear by means of the danger call. This is also characteristic of other animals. Similarly the expression of the emotion of fear through a cry, through the expression of face or the bodily attitude, is communicated from one person to another. The same is true of other emotions, such as anger, and of the less definite feeling attitudes, which we call moods. Dejection or joy may be spread from one person to another by the unconscious reflex power of the imitation of the other's expression.

The teacher or parent is largely responsible for the child's mood. If moods can be thus communicated, it is clear that a child will be more or less permanently affected by the dominant mood of the person with whom he is associated for a large part of his waking life. Observation confirms this conclusion. Attitudes of calmness, of joyousness, of confidence and optimism, and of politeness and consideration, are best developed by contagion. Preaching is without effect if the practicing of the teacher is contrary to the preaching. It is of very little value in comparison with a good example.

The child enters imaginatively into the life of others in dramatic imitation. Make-believe play has already been fully dealt with in the previous chapter. It may be pointed out here that this is the means by which the child is enabled to go beyond direct imitation by the use of imagination. By imaginatively acting out a character, he throws himself into a particular type of personality without having to be directly influenced by another person's presence. In the earliest stages of dramatic imitation the child simply goes through the form of another's outward action, but in its later more developed stages he acts out his conception of another's character. Thus the young man or woman who enters into a profession does not simply go through the mo-

tions of that profession, but for a time also acts a part. The part which he acts will depend on his idea of what a member of his profession should be, and this idea is often adopted from some prominent member of the profession whom he has known or read about. What he does or does not do will be influenced by his ideas of what is appropriate to a member of his profession. In time he actually grows into the character which has existed at first as an ideal or concept in the mind. This process may also be thought of as taking place in a more general fashion. One becomes a person of a certain character because at the beginning he thinks of himself in imagination as having that character.

Acts of skill are learned in part by copying others. In the later description of sensori-motor learning we shall see that there are many ways in which one may profit by observing others who are skilled in the act which we wish to learn. There are some features of such an act which we can only acquire through our own individual practice, but there are others which we can be saved from learning in a blind fashion by good models. The child does not have to learn through blind trial how best to hold his pen in writing — at least so far as the chief features of the matter are concerned. These have been discovered in the past, and he can learn them by observing others or by being told how to act. The same is true of handling any tools, or of learning games of skill or gymnastic feats. It is important that the child be saved useless experimentation in such matters as he can learn through imitation. The development of an act of skill is not useful mainly as an opportunity for thinking, and therefore the value of independent experimentation in this field is very little. It is very important, therefore, that the teacher of any act of skill should be able to show the child how the act is to be performed. He must therefore have skill in the act himself.

In suggestion the ideas or attitudes of others are adopted uncritically. We are concerned in suggestion not so much with the communication of general moods or feelings from person to person in a reflex manner, which has already been described, but with the communication of more definite ideas or attitudes toward particular things as a result of the influence of one person upon another. The person who receives the suggestion is not aware of the manner in which he is influenced. A simple illustration may be taken from the experiments on report. If a person is asked to report from memory what he has seen in a picture, he can frequently be led into saying that he saw objects that were not in the picture at all. If one asks such a question as, "What kind of picture was hanging on the wall?" when, in fact, there was no picture at all, he will frequently obtain from his subject a definite description of a picture. In the Binet tests the child is shown six pairs of lines to compare in length, one at a time. In the first three the line upon the right-hand side is longer than the line upon the left-hand side. In the next three both lines are equal. The child will very frequently continue to say that the right-hand line is longer, or in some cases he will be led by negative suggestion to report that the left-hand line of one or more of the last three pairs is the longer. In every-day school practice the child is very frequently influenced in his response by the manner of the question. Such a question as, "Do you not think that this picture is pretty, or that this person in the story did right?" directly suggests an answer. From the point of view of a test of the child's judgment such responses are of no value whatever. Such questions are called in courts of law leading questions. Their use with children may be allowable in those cases in which the teacher wishes to form the child's opinion, but if the aim is to develop the child's own judgment or to discover what the child's judgment is,

then a question which does not imply its answer must be used.

Suggestion is a legitimate means of moral training. The view that the child should develop independently of social influence would not permit of the use of suggestion in the growth of his moral ideas and standards. But such a view is contrary to the obvious facts of human nature. Persons who have been brought up to different views on some moral question, such, for example, as the observance of Sunday, or the use of alcoholic beverages, are ready to defend their views with arguments, and believe that their view is based upon a rational interpretation of the reasons for their conduct. The fact that the large majority of people accept, in the main, the belief in which they were brought up, and that people who have been brought up differently will defend with equal force their opposing views, indicates that these views have been developed chiefly through suggestion and not through deliberate thought. Reflection is resorted to in explaining or in justifying one's views, but in most cases it was not used originally in forming those views. It is true, of course, that the more enlightened and independent individuals develop more or less away from the traditional beliefs of parents or teachers, but this independent thinking is seldom as important as the less conscious influence of early examples and teaching.

Desirable suggestions are a defense against undesirable ones. As the child grows older he becomes more independent in his moral judgment; but he seldom modifies the main foundation of his moral attitudes, and in the period of childhood this foundation is largely laid by suggestion. The child is open to suggestion whether we will or no, and our only choice is to see that the suggestions are good rather than evil. The conversation in the home, the manner of speaking concerning other persons and their actions, or

even the tone of voice or facial expression with which an act is referred to, has a strong influence in forming the child's own attitudes. The child may acquire a strong immunity to direct attempts to influence him by preaching, but he is always sensitive to the standards of conduct which the people about him are observed actually to live by. It is doubtful whether much talking about principles of right conduct is a successful method of moral training in the school; but the child may be strongly influenced by the attitude which he observes the teacher, or elders, or the other children to take with reference to particular acts which take place under his observation, or with reference to the conduct or attitude of those about whom he reads.

The influence of suggestion is opposed by the critical attitude. The reason that suggestion has force over us is that we do not meet it by ideas which would serve the basis of an independent judgment. The extreme form of this giving up to suggestion from without is seen in hypnotism. Suggestion may go so far in the hypnotic state that a person will believe a blank piece of paper to be a check. We may describe the state of mind to be one in which all of the mental processes except those through which the suggestion comes are asleep, or at least are not brought to bear upon the idea which is presented. The ability to bring one's experiences and ideas to bear upon a suggestion, in order to judge of it independently, is one which develops with age. Its development is dependent partly upon the acquirement of those experiences which will serve to check up the presented idea, and partly upon the attitude of self-possession in which one preserves his own independence or judgment in the face of outside influence. This attitude is a desirable one to produce in the child. We must recognize, however, that the child is relatively incapable of it in his early years; and while the attitude of openness to suggestion should not be encouraged, we

must recognize its existence, and, particularly in the realm of moral education, must take advantage of it.

The child has native impulses to independence. It would be a mistake to leave the subject of suggestion with the implication that the child is completely absorbed in the effort to copy or to conform to other people. Strong as this impulse is, it is checked up by the opposite impulse which at times is still stronger. At the age of about three the child passes through a period in which there appears the opposite attitude or bias. This period is sometimes called the period of negative suggestibility. The child has the impulse continually to do the opposite of that which is suggested to him. He seems to be controlled by what in common language is called a contrary spirit. To one who is not familiar with the development of children this trait appears to be an evidence of innate depravity, but in reality it is simply the expression of the child's disposition to develop his own individuality, rather than to conform completely to the influences from the outside.

In the period of later childhood, from about eight to twelve, the child sometimes passes through what has sometimes been called "the young barbarian period." At this time he seems to lose a good part of his desire to become a conforming member of the society about him, and becomes absorbed in working out his own individual desires and purposes. He is not particularly sensitive to the customs and demands of society and finds it irksome to have to do the little things which are demanded of him because they are the things to do.

In the period of adolescence the child regains his sensitiveness to the opinion and attitude of the group, but it is the group of his own fellows rather than adult society to which he is the most subservient. He is in the period when, as a member of the clan or the group, he has a disposition

to rebel against the traditional restrictions of adult society. Here again there appears the impulse to independence, although in this period it is complicated by the fact of his dependence upon those of his own age.

The current school practice places emphasis on initiative and self-reliance. There have been many educators, from the time of Rousseau to the present, who have criticized the school because it subjects the child too completely to the will of his elders. It has been pointed out that the development of strong intellectual and moral character depends upon independent effort and discovery. The most prominent modern representative of this view is Madame Montessori. In expounding her theories of child development, she asserts that directions or commands by the teacher should be excluded so far as possible, and that the child should be left to his own devices to use the apparatus which is presented to him without interference from others. It is true that in the actual conduct of the Montessori method much restriction is placed upon the child. In the first place he is restricted to the use of the material which is furnished him, and he can only do with this material that which it was intended for. In the second place, while direct command is reduced so far as possible, the child is influenced very greatly by suggestion. This method is therefore not calculated to produce so great independence as it pretends to do.

Independent thought is a prominent element in social life. Writers on social psychology have often laid great stress on the imitative or suggestive side of social life, so as to make it appear that this was the chief consequence of contact of people with one another.[1] The action of the mob, in which the individual person is almost completely subordinated to

[1] For a very illuminating account of the effect of social contact in promoting thought rather than mere suggestion, see E. A. Ross, "The Organization of Thought"; in *American Journal of Sociology*, vol. XXII, pp. 306–23. (1916.)

the group feeling and action, is presented as a typical case of social life. Group action in this case is usually dominated or led by some forceful personality, and the independence of each individual is smothered by the group. This results from a restriction on his movements through being packed into the crowd, and from the very intense feeling tone of the group which carries each individual off his feet. This suppression of the will and independence of the individual is the primitive kind of social influence, and it cannot be denied that it exists as a form of social life. The development of civilization, however, has led to the greater and greater independence of the individual person in his thought and action, and there are other typical social groups which represent this higher form of social life. If the mob may be taken to represent the more primitive life, the deliberative assembly may be taken to represent the higher form of social group. In such an assembly there are always persons who, because of their more vigorous thought, are more influential in guiding the deliberations than the others; but there is opportunity afforded to each person to contribute his own ideas, and the composite result is based on the contribution of many individuals, rather than on the dominant leadership of a single person. This must be looked upon as the sort of interaction between persons which is to be desired, rather than the more primitive form which is represented by the mob.

Educational practice and theory have drawn the contrast between obedience and freedom. Obedience has often been regarded as the center and essence of moral conduct. We are often told that the child's first duty is to learn to obey. There is much to support this view. Action is moral only when mere impulse and desire for self-gratification are subjected to law, or to a broader principle of conduct, and to the social feeling. A person who acts merely from impulse, even though his impulse be good, cannot be thought of as

acting morally, unless this impulse is the habit which has resulted from his previous choice. Unless one subjects his personal whims to the recognized principles of right his action cannot be said to have moral character. On the other hand, it may truly be said that if a person acts simply from outward compulsion the action does not represent his own personality. He is simply the instrument or the agent of the will of some one else, and hence his actions cannot be thought of as moral.

The child's moral nature is the result of growth. The solution of this difficulty is to be found in the fact that the child, in the beginning, does not possess a full moral character, and that the business of education is to lead him gradually in the development to full moral stature, and to control the formation of his habits through the period when he is largely dependent upon others for the guidance of his conduct. Conduct does not depend simply on intentions for its guidance, but also upon knowledge and experience; and the older person, because of his greater experience and knowledge, and also because of his self-control which has resulted or should have resulted from his greater maturity, has a large share of responsibility in the guidance of the child's conduct. To shrink from this responsibility on the theory that development of character is from within rather than from without is to fail to recognize the undeveloped nature of the child at the beginning, and the fact that the attainment of self-direction is a gradual affair. The child must first learn to obey his parents and teachers because their knowledge and maturity give them the necessary authority over him. As a result of this obedience he will develop the disposition to subject himself to principles of right conduct, and will be able to guide his own conduct when he reaches the stage in which he can himself see what is best to do.

The exercise of authority, it must be admitted, does not always produce this desirable result. Authority frequently arouses in the child revolt, instead of producing the virtue of self-control and subjection to law. Authority must be exercised without thwarting the development of judgment, initiative, and self-control. External control must gradually merge into self-control. This is to be brought about by making a distinction, which the child finally comes to recognize, between arbitrary commands, expressing merely the desires of the older person, and the enforcement of a law or principle which the child recognizes as being both over himself and the person who gives the command. The adult must stand simply as the representative of this law, and not as a personal dictator. The child must see that the thing commanded is to be done because it is right, and not simply because some one wishes him to do it. It may be necessary in the preliminary stages to enforce commands without giving reasons, because the child is not capable of understanding the reasons, and because they will use the opportunity simply as a means of evasion. But even after he arrives at the age when he can himself recognize something of the basis of the requirements which are laid upon him, he needs the support of another to back up his own resolution. The same principle holds also with adults. The only difference is that in their case the support is given by public opinion and, if necessary, by law. The older person stands toward the child in place of this broader public opinion, until the time comes when he is able to recognize it and bring himself into conformity to it.

2. The social periods

Mention has been made in connection with other topics of the differences in the child's attitude at different ages. The present section will briefly summarize the changes

which take place in the child's attitude toward the social group in general as he develops from the period of infancy to maturity.

Infancy may be called the breaking-in period. The child starts life as a complete individualist. He enjoys the presence and approval of others, but he recognizes no duties or obligations to others, and his own desires and wishes are the sole, or at least the chief, impulse in his conduct. " I want to " is a sole and complete reason for any action, or the possession of any object. Gradually, through reward and punishment, and to a less extent through affection, love of approbation, and so forth, the child is led to subject himself to the interests and wishes of others. With the exception of the period of negative suggestibility, at about three, which has already been mentioned, the child enters into the period of early childhood so transformed that he seems for a time to subject himself almost completely to the social will.

The period of early childhood is the period of docility. After the rebel period of negative suggestibility the child usually becomes very teachable. It is during this period, in the kindergarten and the primary grades, that the child is willing and anxious to learn the various social arts which are taught in the school. It is not necessary at this time to bring to bear upon the child those influences or motives to lead him to do his school work which are found to be necessary in the following period. The child realizes his dependence, his weakness, and his lack of knowledge, and is anxious to make good his deficiency so far as may be.

The intermediate period — the period of individual independence. The intermediate period of the child's school life has long been recognized as presenting particular problems of control, and of guidance of the child's interests. It has already been pointed out that the child of this period has

been characterized as a young barbarian. He does not recognize or particularly desire to conform to the customs and usages of society. A trivial illustration of this attitude, in the case of the boy, is the carelessness which he exhibits with reference to such matters of personal appearance as a clean face, or brushed hair, or neat clothing. This attitude of independence has sometimes been met by the exercise of further authority, and by subjecting the child to a greater degree of formal drill and memorization, as an answer to his revolt against this type of work, which to him has become less interesting and more or less meaningless. This practice rests upon a theory in regard to the nature of the child's intellectual development at this period which we shall see, in a later chapter, to be ill-founded. While the older child is capable of drill, and of enduring rather severe work, he is also capable of a greater amount of initiative than is the younger child, and his social attitude disposes him to greater independence. This is the time, then, when he should be put more upon his own resources. The somewhat excessive attitude of personal independence which he exhibits at this time can be left for correction to the social instincts which develop in the next period.

Adolescence, the period of the development of the group spirit. The development of a sensitiveness to the group attitude, and of a disposition to coöperate, has been commented on in several connections already. The youth awakens from his preoccupation with his own interests and desires to a sense of the larger world, and to interests in enterprises which can only be worked out by a group of persons working together, rather than by an individual working alone. He develops a sense of social responsibility, which is a different thing from the unquestioning docility of the young child. A symptom of this development is his growing interest in preparing for and getting a life job.

Work has been defined as the activity by which one makes good in society, and the type of work, at least, in which the youth becomes interested is of this sort. The youth now becomes keen to find a use in the studies which he takes, and he seems for a time to have less disinterested intellectual interests than he had in the period which preceded. The vocational interests may become strong enough to cause the child to desire to leave school, and this must be met by showing him that his school work is of use in the preparation for his later life, thus leading him to lay a broader foundation for his future career. Supplementing this interest are, of course, the broader human interests as expressed in literature and history, the intellectual interest in discovery, or in working out scientific principles, and the æsthetic interest as manifested in art or literature. But to attempt to smother the vocational interest, and to substitute these other less intense interests, is to cause the youth to do his school work in a listless and half-hearted manner, and to transfer his more intense interests to activities outside his studies. The attempt to make the work of high school and college rest chiefly on motives of self-culture is to substitute what is essentially, in the life of the majority of individuals, a play attitude, for the serious work attitude which is now developing. It is not surprising under these circumstances that the student frequently devotes more time to his student societies or to athletics than he does to his school or college work.

QUESTIONS AND TOPICS FOR DISCUSSION

1. Compare the position taken in the opening paragraphs with that of Dewey in the article referred to below.
2. Find other illustrations of reflex imitation in animals.
3. Find examples of dramatic imitation in the child.
4. Are different persons alike in suggestibility? Give illustrations.
5. Give one specific illustration of a case in which suggestion is desirable, and one of a situation where it is undesirable.

6. Illustrate the value of initiative in life outside the school.
7. What should you say is the relation of training to initiative?
8. Discuss the statement: The first and most important virtue in the child is obedience.
9. Show how the vocational interest is social.

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CHAPTER VI

INSTINCTIVE SOCIAL ATTITUDES, AND TYPES

1. *Instinctive social attitudes*

Among the prominent social attitudes of the child is the love of approbation. Sensitiveness to the expression of approval or disapproval of other persons appears early in the life of the child. This sensitiveness is at first to the more outward or more obvious forms of expression. A word of anger, or a look of pleasure accompanied by a smile, is responded to by the child even in the period of infancy. Sometimes the child is thrown into a fit of weeping merely by the tone of voice in which he is spoken to. The response of the child by smiling to the smile of another person may be observed in the first year. This sensitiveness to the approval or disapproval of others is of great influence in governing actions of persons of all ages. The adult finds it very difficult to do things which are not regarded commonly as the thing to do, even although he does not think of any one person as expressing disapproval. Even in trivial matters, such as wearing a hat out of season, this sense of the attitude of other persons is very powerful.

Differences with age. The young child is more sensitive to the approbation of older persons than he will be as a youth. The youth pays more attention to the attitudes of those of his own age and social group. In order to influence the youth it is necessary to govern or control the attitude of the group as a whole, which constitutes the public opinion to which he feels himself subject. It is easier to reach the young child by direct individual influence. It may be that this is due to his greater feeling of dependence. As the youth

outgrows this childish feeling and becomes more independent, he chafes at the necessity of governing his actions according to the opinions of an older person.

Children of all ages are particularly susceptible to the attitudes of their mates. In spite of this distinction between the child and the youth, it is probable that children of all ages are more sensitive to the approbation or disapprobation of those of the same age than they are to the attitudes of adults. An illustration of this may be taken from the life of a child five years of age. This boy had not yet had his hair cut short, and was perfectly satisfied with the manner in which it was cut until some of his playmates called him a sissy. He was thereupon very anxious to have his hair cut in the same way as the other boys. When asked what a sissy was he could not tell, but he knew it was something undesirable. If his parents had applied such an epithet to him, it would probably have had much less effect.

The characteristics which inspire the desire for approval. There is a difference also in the child's degree of sensitiveness to approval by others according to the individuality of the other persons. The approbation of some persons is more effective than that of others. One of whom a person is afraid will inspire a desire for approval. This, however, is only operative when the person who is feared is present, or when it is felt that he is capable of doing something that will be unpleasant. Severity of manner may be the source of such fear as well as punishment. A more wholesome and effective source of desire for approval exists when the child recognizes that another is sympathetic with his desires and purposes, and when he has respect for the person whom he feels to be in sympathy with him. The child must feel that a person is in some way superior to himself in ability, or in attainment, or in moral force, if the desire to please that person is to be intense.

The child exhibits sympathy. Contrary to the opinion which is sometimes expressed, the child is also capable of entertaining concern for the welfare, and sympathy for the feelings of others. It is sometimes said that the child is wholly selfish in his attitude toward his associates; but there is very clear evidence that this is not the only attitude of which he is capable. In the early years his sympathy is of the nature of an instinctive, mechanical response to the outward expressions of pain or grief. The sympathy in this case seems to be little more than a reflex imitation of the expression of the emotions, and the effect which this has in producing a similar emotion in the imitator.

Sympathy develops with the growth of imagination. As the child grows older he becomes capable of placing himself in imagination in another person's position, and of making somewhat the same response which he would make if he were in that position. Through the imagination he may sympathize with a friend concerning whose misfortune he had received word, without witnessing his friend's distress, or receiving a direct emotional appeal. The sympathetic person's response to the misfortune of another is not *identical* with that which he would make in the same situation. For this reason he is able to render service to the person in trouble, because he can have a more detached attitude of mind toward the difficulty. Because he does not wholly adopt the attitude which he would have if he were in the same situation, however, does not mean that he has not in some degree the same feeling. Sympathy is this tendency to put one's self in the place of another or to identify one's own interests and welfare in a measure with those of another.

The young child exhibits rapid alternation in mood. There is a marked change in the kinds of sympathy which the child can experience at different periods. In his early life the child is chiefly responsive to the outward expressions of

distress or pleasure, as has already been said. Along with this goes the rapid alternation from an attitude of sympathy to one of a different or perhaps an opposite sort. The child may be angry at a person one moment or be jealous of his possession of some coveted thing, and the next moment be sympathetic with him. He may even, as a result of anger, cause pain to another, and in the next moment be sympathetic because of the pain he has caused. Thus we may observe the very rapid alternation in the child between the attitudes of sympathy or of affection and those of jealousy or anger.

Later, permanent attitudes are developed. This illustrates a general characteristic of the child and one which perhaps has led to wrong conclusions. His whole social attitude is impulsive in its nature instead of consisting of permanent sentiments, such as that of hatred. As he grows older the child becomes more reflective and self-conscious. He is not merely moved by the feeling of the moment, but he broods over this feeling, and develops in his mind an attitude toward a person which remains even when particular occasions for it are not present. This has a very important effect upon the moral bearing of the child's social responses.

The child exhibits affection. Somewhat like sympathy, but not identical with it, is affection. The child can very early respond to expressions of affection, and very early he manifests such expressions himself. One of the most striking illustrations of the fact that the child appreciates such expressions, is the jealousy which he often exhibits when they are bestowed on another child. This fact ought to be recognized in dealing with the child. We make a mistake when we think that the child is swayed merely by pain and pleasure, and when we attempt to deal with him in a cold and calculating way. The child has a different attitude

toward persons from that which he has toward inanimate objects. He more or less vaguely recognizes that another person's reaction toward him is a different matter from the effects which are produced by physical objects. The failure to recognize this social atmosphere in which the child lives is the great defect of Herbert Spencer's doctrine of natural punishments, which would make one's responses to the child of the same mechanical, unvarying nature as the laws of the physical world.

Sympathy and affection are important means of governing the child. These positive feelings with reference to others — the feelings which lead the child to appreciate and be sensitive to the welfare of other persons — form an important leverage by which his development can be governed. The recognition of them is important, since otherwise the attempt is made to control the child wholly through fear or through his self-interest. If these are the only motives which are appealed to, they will, of course, seem to be the most prominent in the child; but if the responses of sympathy and affection are encouraged, they will grow in strength and become important elements in the motives which govern his actions toward others.

In jealousy one sets his own interests over against the interests of another. Opposed to the feelings of sympathy or of affection are those of jealousy and anger and the less pronounced attitude of emulation. As in sympathy one's own interests are identified with those of others, in jealousy a sharp contrast is recognized between one's own good and that of somebody else. We may trace this feeling in the life of the lower animals. A dog may have no hostility whatever toward another until the other is seen in possession of some desirable article of food. This immediately arouses, provided the animal is hungry, a belligerent attitude. Because it recognizes that the possession of the desired thing by

another prevents its own possession, anger toward the other is aroused. Jealousy may even go so far as to cause things to be regarded as valuable because others possess them. This, of course, is the attitude which is portrayed in Æsop's classic fable of the Dog in the Manger.

Anger is commonly the response which is made to opposition. Anger, while not identical with jealousy, may accompany it, or it may be aroused in other situations than those which awaken the jealous response. It is a more general attitude of mind which may not only be adopted toward other persons but also toward things. It is aroused most readily by some obstruction to the course of one's action or the fulfillment of one's purpose, or when one is deprived of a coveted possession. The child exhibits the emotion of anger very early in his life. For example, if he is led to expect that he will be fed when he is hungry, and then is disappointed, he exhibits all the outward forms of the expression of anger. His anger is easily aroused when the freedom of his movements is obstructed, or when he is prevented from obtaining something which he is attempting to get. These continue to be the kinds of situations which arouse anger throughout the various stages of life.

Anger and jealousy are to be supplanted rather than directly suppressed through punishment. Anger and jealousy are perfectly natural and normal manifestations on the part of the child. In fact, there are situations in which the adult should also be angry. They should not, therefore, be regarded as expressions of depravity, nor should they usually be directly punished. The child has the capacities which make it possible in any particular case to take one attitude or another. His education should consist in leading him to take the attitudes which are desirable. If this is done, the undesirable attitudes will gradually fall away or develop into different forms. We have seen that the child does not

possess merely the capacity for those responses which are inimical to others, but that he also has the germs of the development of the friendly attitudes. Education does not consist, then, in directly suppressing certain kinds of response and creating new forms in their stead, but rather in encouraging those desirable forms which already exist, thus causing the others to be starved out through being supplanted by the better.

Anger should not commonly be met with anger. In the treatment of anger, if one attempts to suppress it by meeting it with a display of anger in return, the result is usually the aggravation of the original trouble. One of the common sources of the attitude of anger is its expression by another toward one's self. It is true that if another person exhibits anger, the result may, under certain conditions, be fear, or amusement, or some other response. In spite of this possible variation of response, the expression of anger usually has the tendency to reproduce itself in the one toward whom it is directed. The older person, then, by exhibiting anger toward the child, is merely adding fuel to the fire. While the child's attitude may be excused because of his immaturity or lack of control, that of the adult cannot be excused on the same score. That this mode of treatment is usually not calculated to overcome the difficulty is contrary to the opinion expressed by some authorities, who hold that a child should not be punished in cold blood, but in anger, and that punishment given in this spirit will commonly have the most wholesome effect upon the child. With this view the writer cannot agree, on the basis either of theoretical considerations or of observation. For the adult to become angry with the child is for him to put himself on the same plane of instinctive impulse. He is then merely meeting force with superior force. He fails to lead the child to see that his anger is an unintelligent mode of expression, and to induce him by

the calm consideration of other aspects of the case than those which aroused his anger to produce in himself contrary forms of emotional attitude.

Other modes of treating anger. There are other ways of treating anger which make the child aware that he is exhibiting a type of emotion which does not meet with social approval. One may, for example, make the child see that his display is ridiculous by friendly bantering, or the like. In particular cases to show that one is aggrieved is a more effective method to pursue. The mode of treatment depends on the child. It may sometimes be necessary to show some warmth of indignation which the child may recognize not as personal resentment but as disapproval of wrong action. In this way the child will come to make distinctions of right and wrong between actions which at the start are merely instinctive responses.

With increasing maturity the child gains control over his impulses. As has been implied, the older the child grows, the more he becomes capable of getting above his instinctive reactions and of controlling them by controlling the ideas by which they are produced. The child is largely absorbed in the feeling or idea of the moment. The means of gaining control over the momentary impulse is the ability to bring to mind other considerations than those which have produced the momentary attitude. As one becomes less impulsive and more reflective, he gains the power of exercising over his own responses somewhat the sort of control which the older person can exercise over the responses of the child; he becomes capable of substituting the response which he has come to recognize as more desirable for one which in his calmer moments he recognizes as undesirable.

Anger develops into indignation. What has been said should not be taken to mean that the emotion of anger is wholly useless or undesirable. We recognize this when we

distinguish between anger and indignation. We disapprove of anger, first, chiefly because it is impulsive in its nature, and is an expression of lack of self-control. We disapprove it further when it is based exclusively on a sense of personal injury. In anger one does not consider necessarily whether the source of his anger is just or unjust, whether it is reasonable or unreasonable, or whether there is any legitimate cause for being angry. In the case of indignation, whether it is directed toward an injury to ourselves or to somebody else, we always have in mind the consideration whether the action which arouses our indignation involves the violation of right or justice. The ability to be indignant, then, means that a person is capable of distinguishing between a just and an unjust act. The child may be indignant as soon as he can recognize justice and injustice. We sometimes make the mistake of believing that the development of this response is delayed until a late period of life. The common view probably is that indignation does not appear until about adolescence, but there are clear evidences of a much earlier beginning of the reflective attitude of mind.

Jealousy develops into emulation. As anger is based upon an attitude which goes beyond the simpler instinct to the more complex attitude of indignation, so jealousy may lead to the less violent and more permanent attitude of emulation. While the jealous person does not at the same time entertain a benevolent feeling toward the object of his jealousy, emulation may exist together with an entirely friendly feeling. It is therefore not necessarily an undesirable attitude of mind. When it is directed toward objects which are in themselves worth while, it frequently forms a useful stimulus to effort. It is very easily misdirected, however, as when it causes one to strive for objects which are not in themselves worth while. It is also undesirable when, as is frequently the case, it leads a person to strive for things

which are beyond his capacity, or which do not lie in the direction of his abilities. Thus a pupil in school may be led to give undue attention to one particular kind of work because a prize is offered in that work, whereas he has greater capacity in some other direction, and his efforts in this other direction would be rewarded by results of greater consequence.

Emulation should not be a substitute for direct interest in the activity. It is probably safe to say that when emulation becomes so intense that it causes one to desire something that otherwise would awaken no interest it is out of place. It is true that one might argue that we may properly through emulation induce the child to learn that which would otherwise have no interest for him, but which is essential to his education. It is to be said in opposition to this argument, however, that things which are learned in this way are less thoroughly learned and produce fewer associations in the mind than things which are learned for their own sake, and that in addition to this the child is forming an undesirable habit of mind. It is not likely, moreover, that it is necessary to resort wholly or chiefly to emulation to induce the child to learn anything which is essential. The child has such intense curiosity and takes such great pleasure in successful accomplishment that the possibilities of such motives should be exhausted before we assume that the child's interest cannot be awakened.

Emulation, properly safeguarded, naturally supplements other motives. Because emulation in excess is harmful it is not necessary to go to the other extreme and hold that it cannot be used at all. As was said in the chapter on Play, competition is a natural form of activity. We could not entirely eliminate it if we would. What we can do is to avoid misusing it. One safeguard which has already been mentioned is to encourage emulation chiefly between groups

rather than between individuals. Another is to avoid too much artificial stimulation. It is a question whether prizes do not usually produce such excessive artificial stimulation. If a prize is to be offered at all, the best kind is one which gives opportunity for further attainment, and not simply for enjoyment.

2. Social types

There are individual differences in social attitudes. During the consideration of these forms of social response in the child it will doubtless have occurred to the reader that there are differences in different children in the comparative prominence of the various traits. In some children the attitude of sympathy will be more prominent while in others jealousy will be the dominant attitude. The same distinction between types appears in another form of social attitude which has not been mentioned, — namely, bashfulness and sociability. In some persons the instinct of sociability is much stronger than that of bashfulness, and they seem to have no difficulty from the distressing embarrassment to which others are subject. In persons of the latter type, bashfulness may be so strong that they are not comfortable in the company of any but their intimate friends. We may then attempt to distinguish some of the more important forms of social types. This distinction does not mean that all persons can be classified as belonging to one or the other extreme. It means merely that persons may vary in one direction or the other, and that extremes are occasionally met with. In the practical application of these facts it is the extremes which raise the problem. The majority of persons belong in this, as in other cases of individual difference, to the intermediate type.

Individuals may have positive or negative self-feeling. The first distinction on which types may be based is one

which is not confined merely to one's social attitude, but it is especially prominent in this connection. The distinction on which this type rests is between an attitude in which one feels self-confident, able to meet the situation which confronts him, with an accompanying sense of satisfaction or pleasure; and the opposite attitude in which one has a sense of incapacity, of depression and of inability to meet the demands which are made upon him. These two opposing attitudes are sometimes called positive and negative self-feeling.

Positive and negative self-feeling do not necessarily go with the possession or the failure to possess ability to meet the situation. A person with negative self-feeling may be capable and efficient, whereas one with positive self-feeling may be inefficient. Positive and negative self-feeling each finds extreme expression in a particular form of insanity. In the one case there is elation, sense of power and of capacity, and in the other case is melancholy and depression. In neither of these cases is there anything in the facts to justify the feeling. In the same way in normal mental life there may be something of elation or depression which characterizes a person's attitude without regard to the causes which may exist for the feeling. The cause may be native temperament or the condition of health and degree of physical vigor.

Both extremes should be discouraged. When a person represents either extreme, his attitude furnishes something of a problem to those who have in charge his education. The person with extreme positive self-feeling is apt to be over-confident, to overrate his powers in comparison with those of his associates, and to underestimate the difficulties which confront him. He is apt to act in a reckless fashion without due consideration of the difficulties. The person with negative self-feeling, on the other hand, needs to be

encouraged to attack the problems of his life and vocation. The difficulties appear to him to be larger than they should, and he does not put forth sufficient effort. When properly encouraged and stimulated he may be very efficient; but he is apt, as is illustrated in the extreme case of the melancholic, not to make an attempt because of his fear of failure.

Some individuals are born leaders. There is another group of persons who possess a capacity for leadership in a marked degree. With these is contrasted, not a special group who are deficient in this capacity, so much as all the rest of the people who do not possess this trait in an especially high degree. Studies have been made to determine what it is in a person's mental nature which qualifies him for leadership, and a number of traits have been found to be held in common by such persons.

The leader is self-confident. One of the traits which seems to be most uniformly present among natural leaders is that of self-confidence. In order to be a leader a person must believe that he is capable of planning and carrying out some campaign of action. He must not hesitate too greatly, at least in the presence of the group which he wishes to lead. The possession of a definite plan of action and confidence in its feasibility is more important, apparently, than the actual worth of the plan. The followers rely more upon the expressed confidence of the leader than upon their own recognition of the worth of his proposed course of action.

The leader plans a course of action for the group. As has been said, self-confidence in the leader is accompanied by the habit of thinking out a course of action for the future. The leader must be prepared with some plan whenever a contingency arises. He must therefore be continually scheming so that he will have a plan to suggest before one is proposed by another. The more thoroughly a plan is worked out in detail, the more effective it will be, although some-

times a vague and indefinite plan is sufficient to bring a group of persons into a united course of action.

Critics are a check on leaders. It has been said that leaders are marked off as a class from the general group of persons. There is, however, another class of persons, who, although they do not have some of the capacities for leadership, yet do not have the disposition uncritically to accept any plan which may be proposed. They, therefore, are not well suited to be either leaders or followers, and are often regarded with suspicion and dislike by practical persons who have the responsibility for carrying on some plan of campaign. These persons may merely take a critical attitude toward plans, and appear usually in the opposition to popular movements. In politics these persons are the independents. A larger view of the whole situation than that which is possessed by the leaders, who are committed to some plan of action, will make it clear that such persons are of great value even although they are not themselves capable of organizing definite plans of campaign. They serve to prevent too uncritical following of leaders, merely because they have the personal qualities which cause people to follow them.

The aggressive type is contrasted with the meek type. Another distinction between social types may be made between persons who are aggressive in pushing their own interests and working for their own satisfaction, and those who have not such a keen sense of their own rights, or disposition to demand the satisfaction of their own desires. The one type of person may be called the aggressive person and the other the meek person. Here again it is important chiefly to watch for and give the proper treatment to those who represent the extremes. The extremely aggressive child needs to be checked and to be led to the development of a recognition for the rights of others and of habits of thinking

for and providing for others' welfare. The meek child needs to have the habits of self-assertion developed, and needs to be led to recognize that his usefulness will depend in large measure upon the degree to which his own individuality is developed.

The coöperative type. There is another distinction which resembles somewhat the distinction between sociable and bashful types and yet is somewhat different. This is the distinction between those who seem naturally fitted for coöperation with others, and those who find it difficult to carry on coöperative endeavors. The coöperative persons may not always be particularly sociable in disposition and the more individual type of person may not be especially bashful. The coöperative person seems rather to possess more of the traits of tactfulness, of the disposition, in following out his own purposes, to consider the ideas and opinions of others, and to modify his purposes in their execution so that they may be in harmony with those of others. Such a person is willing to compromise when compromise seems to be essential to united action.

The uncoöperative type. The opposite type of person finds it very difficult to modify his plans at all in order to adjust them to the opinions of his associates. His plan must be carried out in whole or not at all. He is willing to see the whole purpose wrecked rather than to have it modified in any particular. Such a person is usually more earnest and enthusiastic in his advocacy of measures than is the more practical person, who is willing to compromise something in the means if the general end is accomplished. The one type of person is represented by the politician, who is able to bring things to pass; while the other is represented by the agitator who, while he himself does not accomplish definite results, may so arouse public opinion as to lead to progress in the direction of his ideas. These types may undoubtedly

be found among children, and something may be done to soften the more extreme contrasts. In each case a person who represents either extreme would be usually more efficient if he possessed something of the traits of the opposite.

There is probably no anti-social type among normal children. It will be recognized that, although there are differences corresponding to the various types of persons which have been described, and although extremes in general are not advantageous, yet none of the types which have been mentioned represent the disposition actively to do injury to other persons, or to break down or destroy the relations between people. That is, there has not been included what might be called an anti-social type of person. It is a question whether, among normal children at least, there are any who are entirely anti-social. What we very often regard as an expression of this type of mind is only so regarded because of our blindness to the child's real motives. We may make the child anti-social, perhaps, by our stupid treatment of him, and by our misunderstanding of his real feelings or attitudes. We may even so far mistake the child's motive that when he is doing something intended to benefit another, we blame and censure him because the results are not what the other person desires. We may thus sometimes cause him to adopt for himself an anti-social motive because it is ascribed to him and because he recognizes the injustice of the judgment. Those acts which are more commonly interpreted as anti-social — the "selfish," and even the "mean" acts — are often to be interpreted as due to the weakness of motives which should prevent them, rather than to any positive desire to harm or injure others. The chief problem before the teacher in such cases is to develop in the child in their due proportion such attitudes of mind as sympathy and a sense of justice, which will lead to the less selfish sorts of action.

QUESTIONS AND TOPICS FOR DISCUSSION

1. Is love of approbation as good a motive as interest in the work of the school? Are the two motives opposed to each other? Are a person's motives usually single or mixed? These questions are intended to suggest a discussion of the whole question.
2. Should the attempt be made to suppress all fighting among boys? Why?
3. Discuss the effect and value of prizes.
4. Describe persons of your acquaintance who exhibit positive and negative self-feeling.
5. Do extremely meek children have much influence among their comrades?
6. Give illustrations of anti-social actions. If anti-social actions exist, is there any justification for maintaining that there is not an anti-social type among normal children? Discuss.

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CHAPTER VII

SPEECH

Large importance of speech. Speech has long been regarded as the most characteristic human activity and the one which separates man most clearly from the animals. While this is true in a general way, and the researches into the supposed language of the higher animals have not discovered anything which corresponds to the highly developed human language, yet we shall find here, as in the other forms of mental development, that there are similarities between the child in the early stages of his development and the animal. Those elements of speech which are instinctive, and which serve to communicate feeling, are largely the same in animals and in human beings. But those elements of human speech by which ideas can be expressed are distinctly different from anything to be found in animal language. It is words, which serve to convey or express ideas, that make human speech the foundation for progress in all arts, sciences, and civilization. Before the development of writing, oral tradition made it possible to hand down from one generation to another the beliefs and the philosophy of human kind. The development of language has made possible the institution of laws, and the regulations for conduct which go beyond the mere instinctive reaction of one human being upon another. The handing down of literature and laws of a preceding generation has made it possible for the next one to stand upon the shoulders of its predecessor and progress beyond it. The human institutions of the state, the school, and the church have been made possible by this means of communication. The development of barter, com-

merce, industry, and science all owe a large part of their existence to this human instrument, which enables persons to convey in a definite way their ideas from one to another.

Training in the understanding and use of language is an important part of the child's education. If speech is so important for mental development as has been indicated in the previous paragraph, it is not surprising that it has long been regarded as the most important if not the sole subject of instruction in the school. Recent writers on education have argued that the emphasis on speech has gone to an extreme, and that the other elements of the child's experience — those which he gets through direct contact with the world about him — have been neglected. The error which the school has sometimes fallen into has been to train the child in the use of words without giving him that experience which makes words understandable to him. The mistake is not in giving language training, but in not supplying also the other forms of training which should go with it. The danger in language training is that the teaching should fall into the error of verbalism. In verbalism words are used as the substitutes for ideas, rather than the expression of ideas. When a child uses a word in a sentence without knowing what that word means he is falling into the error of verbalism. This does not mean that language can be dispensed with. The child cannot either learn to express his ideas, or to formulate them in his own thinking, without the use of words. The use of names stimulates the child to distinguish and to give attention to the objects in the physical world. Still more are they the stimulus to the formation of more abstract ideas. A well-coined phrase may be the crystallizing point for a political party. The beginnings of speech lie in the home, but its development and perfection to serve as a more delicate instrument of thought is the duty of the school.

The general impulse to speak is instinctive. So far as concerns the general impulse to expression, and the general mode of expression, speech may be called instinctive. The child does not learn to speak because he recognizes that it is of value to him in a practical way to communicate with others. He has a native impulse to communicate which is exhibited very early in his life. Furthermore, the method which he adopts, even apart from any impulse to imitate others or to be instructed by them, is expression through the use of his voice.

The expression of feeling through the tone of the voice is instinctive. The child, in common with certain of the animals, uses instinctively certain kinds of vocal expression. These are chiefly the expression of the emotions. For example, fear is universally expressed by a cry or a shriek, which is the same among all mankind, and which we recognize without having been taught its significance. In the same way anger, or affection, or the finer shades of feeling, may be expressed or recognized. These forms of tone quality or of inflection, by which the emotions are conveyed to others, do not merely exist as separate forms of expression, but they persist as a means of giving additional significance to the words by which we learn to express our ideas. Speech, then, is both the expression of ideas by the articulation of particular words, and the accompaniment of certain tones, inflections, and even gestures, by means of which the feeling attitudes which accompany the ideas are conveyed.

Words are got through imitation. The special form of articulation which is used in the words of one's native tongue is got through imitation. The child does not have an instinctive predisposition to one language rather than another. The grammatical structure of the sentence also, and the broader forms of usage of the language, the child gets through hearing and imitating others. The models which

are set before the child, therefore, are extremely important as governing the correctness or the appropriateness of the usage which he learns to adopt.

The first words are learned through double imitation. In acquiring the ability to pronounce the words of his native language, the child profits by a sort of double imitation. This is illustrated in the explanation of the universality of the words *mamma* and *papa*. The child, through his own spontaneous babbling, gains control over the production of a few simple syllables. The adult listens to the child's vocal play, and, catching certain sounds, repeats them and applies them to some object. The first words which are thus taken and applied are naturally referred by the parents to themselves. The child then merely repeats expressions which he has himself already used, giving them a meaning which has been associated with them by the adult. As he gains wider and wider control over the production of different sounds, he comes finally to be able to pronounce new words through hearing them. Thus double imitation gives him the starting point for the acquirement of words.

The language which the child learns is conventional. We may examine in further detail the stages through which the child passes in the imitative learning of his mother tongue. We have found that he possesses some forms of expression which are instinctive, and which therefore do not have to be learned. He can convey his feeling to others by the tone of his voice, or by the expression of his face, or the gestures of his body. He early learns to supplement these by pointing to objects to which his attention is attracted, and to which he wishes to attract the attention of others. These may be called natural forms of language. Words, on the contrary, are conventional, which means that we do not understand their meaning instinctively, but have to learn it by experience. This conventional language is made up of articulated

words, and articulated words are composed of definite combinations of vowel and consonant sounds.

Learning to talk consists in substituting conventional words for the more primitive, instinctive forms of expression. The word is at first little more than a means of designating that about which the child wishes to express his thought. It is of the same nature as pointing. The idea or feeling which the child wishes to express concerning an object is given through gesture or through intonation or facial expression, or a combination of these various means. For example, the child will say *hat*, at the same time pointing to the hat and indicating by his intonation that he wishes it. Again, the child learns to express his desire for something by means of the verb *want*, whereas previously it was expressed merely by the intonation of the voice. While in the earlier speech the subject is usually understood and the object is expressed, the child later finds a word to express also the subject of a sentence. The finer shades of thought expressed by adjectives, adverbs, prepositions, etc., come still later.

Meaning is expressed also through sentence structure. Another means by which the child learns to express definitely that which formerly was expressed through facial expression, gestures, or intonation, is sentence structure and sentence order. In the beginning the difference between the question and the declaration is expressed merely by the intonation, but as the child gains more mastery over the language he gives a different order to the words in the sentence in which he asks a question, from that in which he makes a declaration. The development of compound and complex sentences indicates a further progress in ability in expression. At the first use of sentences the child merely asks questions or makes declarations, and strings one clause after another by the use of the connective *and*. When he begins to use various relative particles such as *when*,

expressing time, or *if*, expressing condition, he is making explicit a form of thought which previously had been expressed merely through the context in which the clauses occur. The progress in mental development in the child may be traced through the kinds of clauses which he introduces into a sentence, and the words by which they are introduced. He expresses a cause and effect relation by the word *since;* and an alternative by the words *either — or.* Such words as *nevertheless* and *accordingly* are not found in the vocabulary of the very young child.

Learning to pronounce presents difficulties. Besides gaining an understanding of more and more complex words and the ability to use them, the child must also overcome difficulties in learning to pronounce the words. This ability in pronunciation is one which is founded in the first instance upon the vocal play of the child. By this means he gains control over the production of the various sounds which are used in the language. It is a still more complex and difficult performance, however, when he not merely pronounces the different sounds spontaneously, but learns to articulate them voluntarily in copying a sound which he hears, and to combine them with other sounds in the syllables of a word. The acquirement of skill in pronunciation is one which comes gradually and is in process of development through a considerable period of childhood.

Pronunciation depends on hearing. The development of skill in this pronunciation depends on the accuracy with which the child hears the sound, or discriminates among the various sounds, on the one hand, and upon the control of the various elements of the movement by which the sound is produced on the other. Development in pronunciation, therefore, may be hastened by calling the child's attention more minutely to the sound of a word, and this may be done by pronouncing it slowly so that the sounds are made

distinctly. The ability which the child displays in distinguishing the various sounds of a language is remarkable, considering the imperfect way in which they are pronounced by adults. In order to hasten the process, those who associate with children should be careful to speak slowly and distinctly.

There is additional difficulty in pronunciation itself. The development of control of the breathing apparatus, the vocal cords, tongue, lips, etc., which are involved in speaking, should be gained by practice in the production of sounds with the attention on the sound itself, and not upon the movement with which it is produced. With the child, it is usually a mistake to call his attention to the details of the movements by which he is attempting to perform an act. The more natural method of learning, as we shall see in a later chapter, is to keep the attention fixed upon the results, while the movement is varied until the desired result is obtained. It is a well-known fact that when one attempts to think of the means by which the habits that are becoming or have become automatic are carried on, one becomes confused. This is particularly true of children. The exception to this rule occurs when the position or movement of the lips, tongue, and teeth is easily seen and may be copied by the child in getting the beginning of control over a new sound.

Speech may be retarded by physical defects or by prolonged baby talk. When the child does not make ordinary progress in learning to talk, as for example when he lisps beyond the usual period, the difficulty may be due to several causes. There is a possibility that it is due to a mental defect, or a physical impediment, such as tongue-tie or a cleft palate. These causes are infrequent, however, in comparison with the whole number of cases; and the difficulty is usually the result of the lack of proper training. When

this is the case the precautions which were mentioned above — the use of distinct and pure speech in talking to the child, and practice by the child in correct speaking — should be insisted upon. The child is often retarded in his speech development by the persistence of baby-talk which is unwisely encouraged by his nurse or parents.

Stammering is a higher degree of the same defect. When the persistence of the infantile characteristics of speech becomes unduly prolonged and is continued into the later childhood, the difficulty is called stammering. In this case it is somewhat more serious since the bad habits have been longer in formation and have become more firmly fixed. They are, however, of the same general character as those which have been mentioned above, and must be treated in the same manner. The difference is that the treatment must be more systematically carried out, and with more persistence.

Stuttering is not so much imperfect speech as partial inability to speak. The interruption of speech in stuttering results from the inability to combine the various movements which make up speech as they should be combined. For example, the child does not properly coördinate the breathing and the production of sound. The breath should of course always be expired or driven out during the speaking of a word or a sentence. In the case of the stutterer the attempt is very often made to speak while the breath is being inspired or drawn in. The lack of proper coördination between the various elements of speech sometimes results in the entire inability to speak. Sometimes the effort to speak results in saying over and over again the same syllable without being able to progress to the next one. This is to be regarded not as the imperfect development of the habit, so much as the breaking down of the habit.

The origin of many of the cases of stuttering is instructive

as to its cause and as to its means of treatment. It is frequently found that a person begins to stutter at some definite time, or as the result of some definite experience. Sometimes it is due to the imitation of another stutterer. Another peculiarity about his defect is that it is not at all times present or equally troublesome. The stutterer can very often speak with perfect freedom under certain circumstances. Some stutterers, for example, can speak in public. Most stutterers can sing without difficulty, and can speak when they are alone. The difficulty is often aggravated when in the presence of certain persons, and particularly in the presence of strangers. These characteristics of the malady indicate that it is chiefly of a mental nature rather than of a physical, and that it should be treated by psychological means.

Treatment should overcome the stutterer's anxiety. The most characteristic symptom of stutterers is an anxiety that they will not speak correctly. This anxiety may be connected particularly with certain words. In such cases the person will be able to speak freely except when trying to pronounce these particular words. The object of the treatment, therefore, is to enable the stutterer to regain his confidence in his ability to speak. Every situation which causes him anxiety should be avoided. It may be desirable for a time not to require a stutterer to recite in class. Some assistance is gained by slow, deliberate speaking. A stutterer may use various devices, such as whistling or speaking rhythmically. While these may assist him, yet the main point is the acquirement of mental control by which he may overcome his anxiety.

Correct habits of speech are not the same as knowledge of grammar. While the child acquires his native language largely through imitation, the school has commonly supplemented this method by instruction in the rules and princi-

ples which govern the usage of the language. The study of these rules and principles is called grammar. The knowledge of the grammatical rule is not the same as the habit of speaking so as to conform to the rule. For example, it is not the same thing to know the principle that the verb and its subject should agree in number, and to construct one's sentences so that the subject and verb shall agree. To take another illustration, a person may have learned through imitation to say "he seen" instead of "he saw," but may persist in the wrong usage even after he has learned to recite the fact that the past tense of *see* is *saw* and not *seen*. On the other hand, a child may have learned the correct usage through imitation whereas he has never heard of the principle. See in this connection Hoyt's investigation referred to at the end of the chapter.

A study of grammatical principles is of value in using the native language. Such facts as these have led many to conclude that the knowledge of grammar is useless and that the time spent on its study is wasted. It is thought that a person will use a language more naturally, correctly, and fluently if he learns it merely by getting his ear and voice accustomed to correct speech, than by analyzing and learning general rules. There are certain points, however, where such habits, formed merely through practice, break down. In the first place, the habits based on imitation cover only the individual cases which have been learned. If a new case comes up the person who has learned solely by this method is at a loss. A knowledge of the grammatical principle will in such a case often enable one to know what construction to use. The principle is general, while the habit, in the main, covers only special cases. Not only is this true in new cases, but it is also true that a knowledge of the general principle helps one out in cases in which a doubt arises as to what construction to use, even if the habit has been previ-

ously formed. Take the common error of the pronoun illustrated in the sentence, " The teacher called on Jane and I." The knowledge that *I* becomes *me* when it is the object of a verb or preposition makes clear what form should be used. If the habit fails, one may have recourse to a rule governing the case. Finally, the study of a rule or principle is helpful in those cases in which one has formed the wrong habit in the first place and needs to break it.

The grammar which has been commonly taught has been too elaborate. While it is probably of advantage to familiarize the child with the chief facts regarding the grammatical structure of his native language, and to cause him to learn the simpler rules, the grammar taught in the school has usually gone into much greater detail than can be justified by its application to the needs of speech or writing. The minute and formal classification, inflection, and parsing of words, and the detailed analysis of the sentence and definition of its component parts, have probably been carried much farther than is worth while. A beginning in the discovery of the kinds of grammatical facts that are profitable to teach has been made in Charters's study of the errors found in the speech of the school-children in Kansas City. The mistakes which the child is likely to make should be anticipated by the development of the contrary habit of correct speech, and probably by learning the rule or principle which covers the case. This will necessitate a familiarity with a few distinctions and grammatical terms. But, if the author may cite his own experience in evidence, the larger share of the formal grammar which has commonly been taught in the school has no discoverable relation to the development of habits of either oral or written expression.

A knowledge of grammatical principles helps in the study of a foreign language. The reasons which were given in the preceding paragraph for the study of grammar apply to all

children. There are additional reasons which apply to those who study a foreign language. The moment a person begins to use a foreign language he comes in contact with forms which differ from those to which he has been accustomed. The sentence order may differ widely, as in German or in Latin; nouns and adjectives may be more highly inflected so as to express various relations by the form of the word itself rather than by the use of prepositions; distinctions in gender may be made more freely, and so on. In the case of all such differences, the student will appreciate more clearly the usage of his own and of the foreign language if he makes some study of the structure of his own tongue either before or during the study of the foreign tongue, and compares the two, than if he merely learns them both " by ear."

Grammatical study should be deferred. The view that a study of grammar is helpful to one who studies a foreign language may seem contrary to the fact that young children learn foreign languages easily in the same way that they learn their native tongue. There would be a contradiction unless it were made clear that grammatical study should not come until the child is fairly well along in the formation of his language habits. As was indicated in the reasons which were given for the study of grammar, this study is not the chief basis for the formation of language habits, nor can it be a substitute for these habits. Its function is rather to supplement these habits by making the reasons for the usages clear to the child. Hence this study does not come properly until the later years of the elementary school.

Oral expression is fundamental. Expression through oral speech is so important for the child's ability in any form of expression, and for his ability in thinking, that its right development deserves especial attention. The child gains a control over oral expression long before he has command of written expression. He therefore is capable of sustained and

fairly complex expression of thought in speech, long before he can express his thoughts with any fluency or ease through writing. It is a matter of common observation that the child in the earlier grades finds it very difficult to compose his thoughts in writing. The writing process itself is so difficult that it distracts his mind from the thought which he is trying to develop. Speaking also encourages a fullness, a fluency, and a connectedness of expression which is apt to be absent from written expression. The child should therefore have ample experience with the easier type of expression, in order that he may be able to develop the ability to express his thought in language by the use of the easier medium.

Writing requires special training. Though written expression is secondary to oral expression, it, itself, requires special training. It is incorrect to assume that because the child has learned to express his ideas in speech, he can express them easily in writing. The changed conditions modify the problem, so that the skill gained in the one form of expression does not entirely meet the demands of the other. In writing it is necessary to express one's thought more clearly and explicitly than in speech. Inflection, gesture, and facial expression may, as in the case of the young child, make the meaning of one's words clear when he is speaking, whereas it would be ambiguous in writing. When one uses written expression, therefore, it is necessary to pay particular attention to the choice of words, to the sentence structure, and to the order of words in the sentence, by which the meaning may be most clearly conveyed. Hence written expression is of value in addition to oral expression in that it gives system and definiteness of thought. Imperfections and inaccuracies which would pass unnoticed in oral expression become evident as soon as they are put in writing. The fact that what is written is presented

to the eye simultaneously also encourages logical arrangement and coherence of thought.

The acquirement of a vocabulary depends on a wide experience with words. The importance of the ability to choose words which best express one's meaning, and the means by which one may learn to use the most appropriate words deserve comment. Studies of the understanding that children have of the words which they have met in their reading, but which are not in their common every-day vocabulary, indicate that their grasp of the meaning of such words is very imperfect. Many children's ideas of such words as *monk* or *armor* are very grotesque, and depend often upon the resemblance of the sound of the word to some word with which they are familiar, or upon some such superficial analogy. It is not sufficient, in order to give a child an adequate grasp of the meaning of a word, that he should read its formal definition in the dictionary. What he needs is wide experience with the word, through hearing it used or reading it in a large variety of connections. If the word is the name of a concrete object, he must have come in direct contact with the object, so that he can recall this experience when the word is used, or at least he must have had the best possible substitute for such experience through pictures or descriptions. To understand words other than those of a concrete nature the child must have met them often in conversation or reading. Those children have the best grasp of words who have the widest experience with them, through hearing them used in the home, and through wide reading. In order to give children in the school the same grasp of word meanings similar experience must be furnished them.

QUESTIONS AND TOPICS FOR DISCUSSION

1. Give illustrations of instinctive vocal expression in animals.
2. How may ideas be communicated otherwise than by words?
3. What are the advantages of words for the communication of ideas?
4. What is verbalism in teaching and how is it to be avoided?
5. Give illustrations of two common errors in speech and of the grammatical principles or rules which they violate.
6. Illustrate the variation of meaning or emphasis which is produced by a change of the order of words in the sentence.
7. Show in more detail than is given in this chapter why it is difficult for the child to distinguish clearly the speech he hears.
8. Give an illustration from your own observation, if you can, of the fact that the knowledge of a rule of grammar does not guarantee against its violation.
9. Illustrate and describe a formal definition of a word. In what way does such a definition contribute to our understanding of the word?

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CHAPTER VIII

ACQUIRING SKILL

The child is born with the ability to make a very small number of movements, besides those of the internal organs. He is not able to walk, or talk, or use his hands in handling objects, or to direct his eyes toward an object, or to focus them upon an object. Some of the movements which later develop are largely instinctive in their nature, such, for instance, as walking. Others the child has to learn largely by experience and practice. An illustration of this type of learning is handling objects, and later the more delicate types of manipulation involved in using tools or writing. The child is born with the ability to perform fewer movements than are the higher animals, but with the capacity to develop a larger number, and greater delicacy of movement than any of the animals. This capacity for development is partly due to the possession of a better adapted organ of movement, the hand, and partly to a more delicately organized nervous system, and a higher intelligence, by which he is able to direct his movements toward the results which he wishes to produce.

Skill is acquired through the formation of connections between sensory stimuli and motor responses. The acquirement of skill may be described in more exact terms as sensori-motor learning. We may take any form of skill we please, and it can readily be shown that in each case the movements are guided by the recognition of outward stimuli, or at least by the sensations which outward stimuli produce. Even such an act as walking, which is in the main instinctive, must be carried on through a delicate and con-

tinuous adaptation to sensations. The disease of locomotor ataxia, or tabes dorsalis, illustrates the necessity of sensations as guides to movement. In this disease the patient loses the sensitivity to touch in the soles of the feet, and to movement in the muscles, joints, and tendons in the legs. As a consequence, the patient becomes unable to walk if he is also deprived of the guiding sensations of the eyes; and in the advanced stages even vision is incapable of serving as a substitute for the other sensations. Sensations are necessary in the development of skill, just as they are in the proper control of movements after they have been learned. In learning to write the child is concerned not merely with movements, but with the adjustment of movements to the form of the letter which he apprehends through visual perception.

1. The classes of sensori-motor learning

In the first class, the task is to connect movements already under control with perceptual elements. We may take as an illustration of this type of learning the maze experiment. This is illustrated in the labyrinths which are sometimes found in amusement gardens. These labyrinths consist of a series of paths on the way from the entrance to the exit, arranged in such a way that many of them lead into blind alleys. The task is to learn to turn in the right direction at each turning-point, so as to pass through the maze by the shortest route, and without having to retrace any steps. Animals, such as the white rat, and human beings are on much the same level in learning the maze. It may be seen on a moment's reflection that the chief requirement in this form of learning is to make the proper association between the situation at each point in the maze where there is a choice of paths, and the movement of turning in the right direction. A second form of learning in which the same

general character is found is that of sorting cards, or of distributing letters or cards alphabetically. Here the requirement is that one should connect the sight of the initial letter of the name on the object which is to be distributed with the movement of putting the object in its appropriate pigeonhole. It is a matter of connecting a movement over which the learner already has control with an object or aspect of the situation, which is fairly easily distinguished from the surrounding objects. Running an automobile is a third illustration of the same type of sensori-motor association. The movements of turning the steering-wheel or of pulling the brake-lever or of pressing the foot-levers are not in themselves difficult or new, but the ready association of these movements with the aspect of the situation which demands starting the machine, or stopping it, or turning to the one side or the other must be learned.

The second class demands the organization of new movements in response to their stimuli. The simplest case of the second class of learning, which illustrates fully only one phase of it, is found in an experiment by Bair on learning to move the ears. This movement is one which is commonly made when one smiles broadly or raises the eye-brows strongly, and the muscles and nerve connections which are necessary to make the movement are present to start with. The chief process which is involved in learning to make this movement voluntarily is its isolation from the movements with which it was originally associated. This has to be done by associating this particular movement with some perception, either the sight of the movement as one looks in a mirror, or the effect which is produced when a system of levers is attached to the ear, — as was done in this experiment. Other examples of this class of learning are more complex, such as handwriting, handling tools, performing gymnastic feats or playing games of skill. In these types of

learning, of which handwriting may be taken as an illustration, it is necessary not only to select the individual movements from the groups with which they were previously associated, but also to associate the individual movements into combinations which did not exist before. In handwriting, for instance, the action of the four fingers, which is similar in the primitive act of grasping, must be differentiated. The first and second fingers must be used in grasping the pen and the third and fourth in supporting the hand. The first and second fingers in grasping the pen must also be associated with the thumb, and these adjustments of the fingers must be associated with certain movements of the arm either in moving along the line or, in the extreme arm movement, in forming the letters themselves. The other examples of this class which have been mentioned — such activities as skating, bicycle riding, and in learning to pronounce new words, or words in a new language — are all illustrations of this process of breaking up the movements which have previously been associated together, and associating them into new patterns.

This type of learning begins with diffusion and involves inhibition. Whenever one attempts to develop a radically new movement, he makes at the outset a large number of excess movements. The bicycle rider exerts altogether too much force in gripping the handle bars and there is a general tenseness of the whole body. The same diffusion of impulse is shown in the contortion of face, and the twisting of the body and the feet, in a child who is learning to write. There is what may be called an overproduction of movement through the scattering of the nervous impulse to other muscles than those which are appropriate to the task. This is due to the fact that the correct associations have not been formed, and it is a necessary condition in order that new paths of connection may be made. The selection of move-

ments from this diffused number of movements has as its other side the inhibition of the useless movements. One may look upon the process either as the selection of the successful movements, or the elimination of the others. From the practical point of view the selection of movements is to be regarded as the primary process, and inhibition simply as the result of the process of selection. In particular, we can select the correct movement more readily by fixing our attention on the result which we wish to produce, or in a few cases upon the movement itself, rather than upon the movement which we do not wish to make. There are some exceptions to this rule, but in the main it holds good.

The elementary movements in a coördination have to be properly combined with reference to both time and force. Such a combination of movements, which is built up through the selection of certain elements of previous movements, and their organization into new groups, is called coördination. The coördination may be faulty through the failure of the movements to follow one another in the proper time, or to have the proper strength in comparison to each other. In all feats of skill the correct timing of the successive movements is a very important element. This is clearly seen in the gymnastic feat which is called the " kip." In this act one suspends himself by his hands to a horizontal bar and swings backward and forward until the body has acquired a rapid motion, and then, when the forward extreme of the swing is reached, raises the toes to the bar and by a sharp upward and outward kick raises the body so that the bar crosses it at the extremities of the arms. The crucial requirement of this feat is that the kick be made at the proper time. If this is done the body is raised with comparative ease; if not it is next to impossible to get the body up. Faults in writing illustrate the improper balance of the component movements in force. If the middle finger, for instance, presses too hard

against the hand on a downward stroke, the stroke is pushed too far to the left. If the thumb presses too vigorously the stroke is deviated toward the right.

Rhythm is a valuable help in forming coördinations. The proper adjustment of movements to one another in time and also in force is promoted by making the movement rhythmically. Rhythm has long been made use of by workmen to assist them to adjust properly the movements of different individuals to one another. For instance, in raising the anchor by turning the windlass, sailors use songs which enable them to give the impulse all at the same time. In the same manner the different individual movements which combine in a coördination seem to work together more harmoniously when the movement as a whole is made in a somewhat regular or rhythmical fashion. A smoothness and ease may be observed in a movement that is rhythmical which is absent from an irregular movement. The rhythmical movement may be made for a longer time without fatigue than one which is not rhythmical. A prominent example of the long continuance of rhythmical movements is to be found in the involuntary movements of the heart, the lungs, and other vital organs. Investigations of handwriting have shown that well-coördinated writing is made with greater rhythm than writing which is ill coördinated. For these reasons, therefore, it is a good practical rule to attempt to develop rhythm in any movement which we wish to learn.

In the third class of sensori-motor learning the series of movements is more complex, and the stimulus to which the response is made is more highly organized. The third class of sensori-motor learning is not different in kind from the two preceding classes, but is rather different in degree. Illustrations may be used to bring out this difference. In typewriting and piano-playing, for instance, the requirement is not that radically new or different or individual

movements be made, so much as that these movements be organized or arranged in complex series or patterns; and this arrangement of the movement is promoted by learning to recognize the words or the groups of notes to which the movements are the response.

2. Methods and factors in sensori-motor learning

The trial and success method is fundamental to sensori-motor learning. If one will examine his experience in learning an act of skill he will recognize that to a large degree he did not foresee the favorable variations by which his movement became better. Nor did he recognize with any degree of clearness how the improvement was made after it came. The good performer is not necessarily a good teacher of others, because he does not know how he himself succeeded. The teacher needs to make a different sort of study of his activity than does the learner; and it may even be that the kind of analysis which is desirable for the teacher is unfavorable to the highest degree of skill as a learner. The attitude of the learner is not to so high a degree the analytical attitude as is that of the teacher. The learner fixes his attention upon the result he wishes to produce and then attempts to repeat the movement which proves successful. The method is more or less one of blind trial. Each successful move is a step toward perfection. For this reason the method is called the trial and success method.

The application of the trial and success method varies in the different classes of sensori-motor learning. In the first class, the trial and success method is necessary in those cases in which it is not possible to foresee what move to make. This is true in the maze form of learning with both human beings and animals. In the true maze one does not have any means of foretelling at each turn what path to take. He can therefore only discover the correct path by

trying one of them out, and governing his actions by the result. If one had a guide to lead him through the maze the learning process would simply consist in associating the right movement with each turn in the path, without previously having to determine by trial what the right move was. It is significant that human beings learn a maze in the same way as animals. In some of the other illustrations of this class of learning, however, the connection between the movement and the stimulus does not have to be discovered by blind trial. This is true, for example, of the act of sorting letters. Here the main purpose of practice is to fix the association between the stimulus and the response. The connection can be learned without having first to be discovered. In such cases as this trial and success is only applicable to learning the best mode of carrying out the movement in detail, such as the best method of handling the cards and throwing them into the box.

When new movements have to be organized trial and success is the preëminent method. In those forms of learning which were included in the second class, such as ball-tossing, skating, bicycle riding, games of skill, handwriting, and pronunciation, our control of the individual movements which are to go into the final coördination is so limited, and so little under conscious direction, that we have no means of determining by analysis or reflection how the new movement is to be organized. This conclusion is emphasized by the study of the development of skill in the psychological laboratory, and by the study of the characteristics of those persons in ordinary life who possess a high degree of manual skill. The study of the development of skill in the laboratory indicates that, in the majority of cases, the learners hit upon the successful method of performing a movement without foretelling how the movement is to be made and without any clear recognition after it was made of the man-

ner in which their success was attained. The improvement seems to come of itself with practice, although strict attention is necessary in order to make good the gains which came thus in unforeseen manner. The study of those persons in every-day life who possess high manual skill indicates that this gift does not necessarily go with high ability in more intellectual pursuits. The exceptionally gifted baseball player, or expert in other games of skill, is not preëminently a person who shows high ability in science, art, politics, or in any other intellectual pursuit. In fact, it is quite common to observe men who have attained high distinction in their calling present a ludicrous spectacle on the golf links or on the tennis court. This does not mean that there is necessarily an opposition between manual skill and more abstract intellectual activities, nor does it mean that thinking may not properly be used in the development of skill; but it means that the fundamental and basic process in the development of skill is not the higher form of thought analysis.

Trial and success is important in the forms of learning of the third class, although it is not preëminent, as in the second. In learning to play the piano, or to use the typewriter, or to carry on other highly organized complex movements of the same sort, there are elements of skill which have to be acquired through the trial and success methods. Since, however, these forms of learning do not involve so radical a reorganization as those in the second class, and since the recognition of the stimulus and its organization is an important element, the trial and success method is not so prominent here as in the cases just described; but in such matters as developing the proper touch, or great ease, freedom and rapidity of movement, the trial and success method is here also essential.

Imitation and verbal direction supplement the trial and success method. It was pointed out under the head of the

trial and success method that a guide might be a substitute for blind trial in learning the maze. There are also certain elements in other cases of sensori-motor learning in which a person who has himself been through the process is able to furnish directions or a model for guidance to the learner, which will somewhat reduce the necessity of discovering the best method of procedure by blind trial. One cannot doubt that the manner of holding the pen, the position of the paper, the attitude which one takes at the desk, and numerous other elements of one's position, contribute toward success or failure in forming a good habit of handwriting. In the game of golf, while a person may sometimes be able to attain a moderately good score although he violates most of the rules laid down by the experts, yet the following of the more fundamental of these rules unquestionably is favorable to the attainment of the highest degree of skill of which an individual is capable. The teacher of the violin or the piano quite rightly insists upon certain elementary practices in hand position. In playing the violin, for instance, the wrist must be kept fairly well arched rather than be allowed to slump down. In learning to use the typewriter it is much better to use all of the fingers than to follow the natural practice of the untrained writer of using only two or three, and there are certain fingers which are best to use in pressing certain keys.

Form can be taught, execution must be learned. The elements of learning which have been used as illustrations of the possible usefulness of imitation and verbal directions may be summed up under the head of *form*. The form of any act comprises those positions or adjustments which one can assume in a more or less voluntary manner, because his previous experience has given him the necessary control over the parts of the body which are used. Thus in handling the tennis racket it is a simple matter to grasp the

handle toward the end rather than toward the middle. In driving a golf ball one can voluntarily assume such a position that the line joining his two feet will be approximately parallel to the direction in which he wishes the ball to go. In studying the process of learning to keep two balls in the air with one hand, Swift found that the learners discovered accidentally that it was better to throw up a ball in a different position from that in which it was to fall so that the ball going up would not collide with the one coming down. There is no reason why the learners might not have been able to adopt this method of throwing if they had been so instructed. The application of blind trial in this case might therefore have been avoided by the use of instruction or by the use of a model to be followed.

Imitation and instruction supplement each other. Imitation has value of a certain sort which is not possessed by verbal instruction, and the reverse is also true. Ordinarily the learner can get the more correct idea of the form which should be adopted by watching the teacher rather than being simply told how to assume the correct position. Imitation should therefore be used as the starting-point. In fact, instructors commonly say that a young learner will adopt the correct form if he has good models to imitate, without any explicit instruction. Frequently, however, the learner does not succeed entirely in assuming the correct position from imitation. He does not realize the difference between his own position and that of the teacher. In such cases it is necessary to supplement imitation by means of verbal direction. That is, the pupil's attention must be called to the points in which his position differs from that of his teacher. By this means he may be led to examine the details of his position more carefully and to correct those which are wrong.

It must not be supposed, however, that the adoption of

good form is the whole story. A person's form may be faultless and yet, in some manner or other which it is difficult to detect, the movement may always go wrong in the execution. The carrying out of the movement is a matter of such rapidity and such complexity that it cannot be directed in detail by means of attention to the details. Form or position is something which can be adjusted slowly and piecemeal. Execution can never be built up in this manner. Recent experiments by Gilbreth indicate that the study of motion picture records of movements may enable the learner to *modify* advantageously his movement in the direction of greater economy, but the possibility of this kind of analysis has not been completely explored. Attention to the details of execution are apt to overemphasize one part of the total movement in comparison to the other parts, and thus to throw the coördination off because the adjustment in time and force is not properly made. To put the matter in another way, in the acquirement of good form one's attention may be largely on his bodily adjustment, but in the acquirement of execution attention must be chiefly on the results which one is aiming to produce. By giving attention to results, after correct position has been assumed at the start, the complementary parts of total coördination fall into their proper places by the process of adjustment through success and failure.

Passive or guided performance may have limited value. It is a serious question whether the completely passive performance of an act contributes anything toward its active performance. That is if one's hand is simply allowed to be guided through the making of a movement, when he is making no effort himself, it is doubtful whether the nervous connections which are essential to the development of the act are affected in the slightest degree thereby. The case may be different, however, with guided performance. In this case the learner is attempting to make the movement, but

does not know just how it is to be made. The teacher may assist him in making the movement, and in this way he gets the feeling of the movement in association with the successful result. It is probable that there is thus some contribution made to the connection which he is desiring to form between the stimulus and the response. Thus Bair found that in the study of learning to move the ears electrically stimulating the ears was of some assistance to the learner. It is commonly believed that to take the child's hand and guide him in forming the letters in handwriting gives him such a feeling of the movement that he is better able to repeat it voluntarily. In gymnastic feats the practice of putting the learner in a harness and assisting him to make the movement is common. One object of this practice, of course, is to prevent injury in performing somewhat dangerous feats, but the experience of making the movement, which is gained in this way, is probably of some assistance.

Reflection or thinking is of limited value in sensori-motor learning. It has already been said that those who are successful in activities which require a high degree of skill are not as a class characterized by unusually high ability in abstract thought, or in intellectual pursuits. There are two possible ways in which thinking may be employed in furthering sensori-motor learning. In the first and simplest, thinking is simply a matter of recalling those experiences of the past which throw light upon the methods of learning. That is, one may recall the methods he used when he was successful, and contrast them with the methods which he pursued when he was unsuccessful. Such methods may be not simply the detailed adjustments which have previously been made, but also the attitudes of mind with which the task was approached. This type of thinking is undoubtedly of value. It is an extension of the trial and success method by means of memory. The other way in which think-

ing may be used is to attempt to figure out theoretically the best adjustments with which to meet the demands of the task. This may be called the application of science to the development of skill. However this may be possible theoretically, it is not the actual method which has commonly been pursued. The baseball pitcher does not learn to throw a curve by the application of the theoretical principles of science. The tennis player does not learn how best to hit the ball to obtain various kinds of strokes through the application of the principles of physics. There is no question but the principles of the sciences do have application in these fields, but the ordinary player certainly is not in a position to discover the best methods to pursue by the application of these principles. There is another way in which science is being applied to the discovery of the best methods of learning. This procedure is illustrated in the experiments upon learning which form the background of the principles set forth in these chapters. Science in this case is not applied to the external situation, but to the discovery of the kinds of adjustments which the learner makes in order to be successful. Science is applied here to the learner himself, rather than to the situation in the physical world which confronts the learner. Even here, while we believe that science has much to say which is of help to the learner, the individual learner can investigate the principles of science for the purpose of discovery to only a limited extent, and then only when the learning is carried on under definitely controlled conditions.

The attention in learning is commonly best directed on the objective conditions and the results of the learner's effort. Certain systems of teaching those acts which involve skill have called the learner's attention to the structure and activity of the bodily organs which are used. There is a school of teachers of singing, for example, which instructs the learner in the anatomy and physiology of the organs of

speech, including the lungs, the vocal cords, the cavities of the mouth, the tongue, the lips, etc. There are certain methods of teaching handwriting which direct the pupil's attention intensely and for long periods toward his hand and his arm, as distinguished from the letters which he is forming. Contrary to these practices, Swift found in his experiment with ball-tossing that the learners directed their eyes and their attention chiefly upon the ball as it went through the air, and that their eyes never, and their attention seldom, reverted to their hands or arms. This represents the extreme opposite of the practice suggested above. In the case of singing this would mean that the learner's attention would be chiefly upon the tone which he is producing and the comparison between this and the model which he was attempting to imitate. In the case of handwriting this would mean that the pupil's aim would be to produce a form which was like the form which he is copying, or to discover the defects in his own writing and to remedy these defects. The extreme practice of giving attention wholly or chiefly to the result which is being produced is preferable to the extreme practice of giving chief attention to the method by which the result is reached. But it is not necessary to choose either of these two extremes. The distinction which has already been made in discussing the different methods of learning will apply to this issue. The discovery or the attainment of good form in the movement may be furthered by some attention to the process, or to the adjustment of the part of the body which is being used. It is related that an American crew defeated an English crew in rowing by means of a stroke which was not at all in accord with the traditional principles which governed the sport. The coach of the American crew had developed what he called the "Git-thar" stroke. His aim had been to discover the kind of stroke which produced the greatest speed, and he was not

bound particularly by the traditional form which had been handed down. The individual, of course, must be conservative in modifying the form which has been determined by previous experimentation to be the best, but he should never lose sight of the results in his endeavor to acquire correct form.

The Golden Rule of sensori-motor learning is much repetition. It follows clearly from the analysis of sensori-motor learning that progress can be gained only through a large amount of practice. This principle has frequently been violated. In drawing and writing in the past the child has been so taught that he produced a very limited amount during a practice period. The drawing book and the copybook were designed to last for a whole year, and yet might be filled by a child using the modern method in a few weeks. The ideal of the older procedure was to stimulate the child to reach a high degree of perfection by slow and painful effort. The principle of the modern method is to tolerate a large amount of inaccuracy in the child's early efforts and to expect him to attain a moderate degree of speed, and then to improve in both speed and accuracy together.

Repetition to be of value must be progressive. Notwithstanding the need of repetition *mere* repetition may be worse than useless. The careless going over of an act without strict attention to the results, so that improved methods are taken advantage of and poor methods are continually being eliminated, serves to confirm the learner in the errors which he happens to be making, or even permits him to fall into new errors. Repetition produces progress only by the application of the principles of reward and punishment. Reward and punishment may be applied in a literal and physical sense, as when an animal is taught to approach red rather than blue, by being given food when he approaches red and being given an electric shock when he approaches

blue. Reward and punishment, on the other hand, may be of a more remote character, and may consist in the satisfaction which follows gradual attainment by the learner of an aim which he has set up for himself. Thus, in learning to write the reward comes when the pupil succeeds better in producing easily and rapidly the standard forms, and the punishment is the uncomfortable feeling he has when he fails. The application of reward and punishment in this case depends altogether on the pupil's discrimination between those efforts which are in the right direction and those which are in the wrong direction. This necessitates that he be given aid in the analysis of his results. He must be induced not only to compare in a general way his own writing with the model, but also to criticize his own writing from various particular points of view, such as uniformity, quality of line, letter formation and spacing.

The feeling attitude in learning must be neither too intense nor too relaxed. The psychologists, Bryan and Harter, in their study of the telegraphic language, laid down the principle, "It is only intense effort that educates." This principle has been questioned by other investigators, who point out that very intense effort may cause anxiety and confusion, and thus retard progress rather than further it. In the consideration of this question we may recognize both the fact that an easy-going or a lazy attitude toward one's work is not productive of gain, and at the same time that anxiety and an effort artificially to stimulate oneself may entirely miss the mark. It is not only necessary to put forth effort, but the effort must be under control. The speed of performance must not be allowed to exceed the point at which accuracy can be maintained. Effort must not be allowed to produce confusion of mind. The application of effort must be consistent and not spasmodic. Finally, the effort to be most productive should not be worked up in an artificial manner,

but should be the result of one's interest and absorption in the matter in hand. His desire should be not so much to put forth energy as to accomplish results. Here, again, attention to the objective results is a corrective of error.

The practice curve is complicated by a number of factors. The first factor which influences the practice curve is the method by which the curve itself is constructed. This is a purely technical affair, and is not influenced by the real

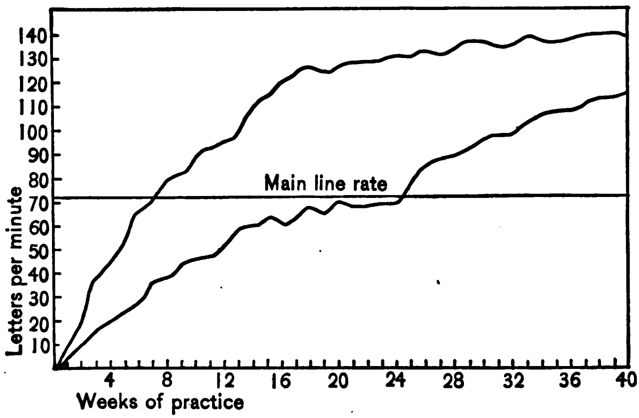

FIG. 11. CURVES OF SENDING AND RECEIVING OF ONE LEARNER IN TELEGRAPHY

(From Bryan and Harter's article in *Psychological Review*, vol. IV, by permission of the publishers.)

nature of the process in learning itself. In general, the practice curve is constructed by plotting a series of points, each of which represents by its height above the base line the degree of skill the learner has reached, and by its position on the horizontal line the stage in the total learning period when that degree of skill was reached. Thus a curve which rises from left to right represents improvement in skill. The method of constructing the practice curve which is

probably the best, is to divide the whole practice period into equal units of time, to be represented by the divisions on the base line, and to calculate the proficiency which is attained at these successive periods of time by the number of acts which can be performed in a given unit of time. For example, in typewriting this would mean that the base line would represent hours or days of practice, and that the height of the

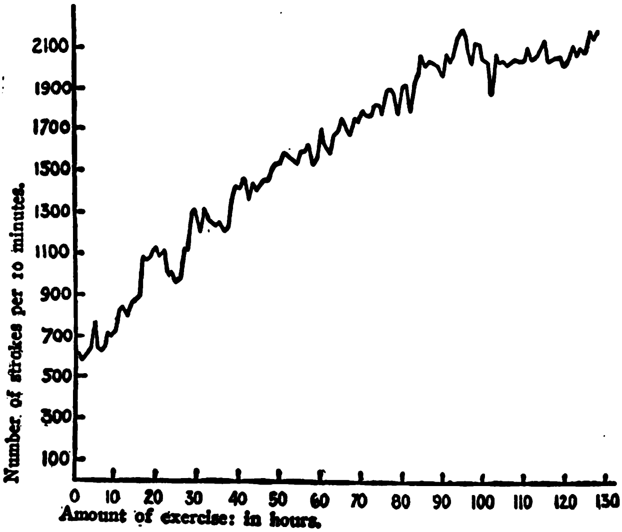

FIG. 12. CURVES OF PROGRESS IN TYPEWRITING

(From E. L. Thorndike's *Educational Psychology*, vol. II, by permission of Teachers College, Columbia University.)

curve above each point on the base line should represent the number of letters which could be written in a minute or an hour. Figures 11, 12, and 13 show three curves constructed according to this plan. The first represents progress in telegraphic language by Bryan and Harter; the second represents progress in typewriting from Book; and the third prog-

ress in mirror drawing. There are evidently represented here three types of practice curves, one in which the progress is rapid for a time and slow later on, showing what is called negative acceleration, another in which the progress is fairly uniform throughout the learning period, and the third which shows more rapid progress toward the end of the

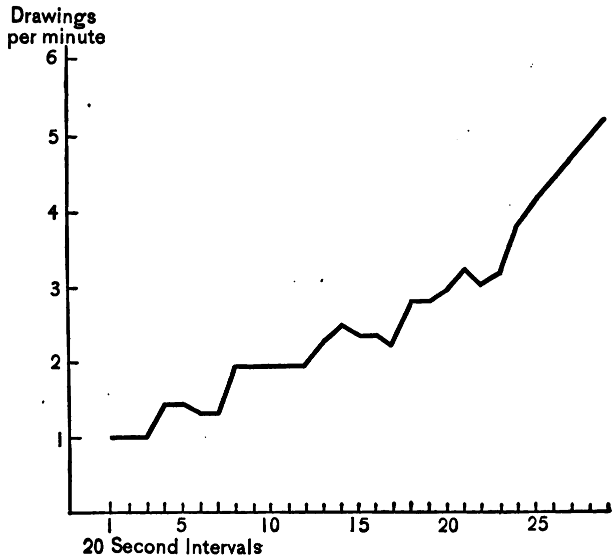

FIG. 13. PRACTICE CURVE IN MIRROR DRAWING

Based on the average scores of a group of individuals (using drawings per minute in equal intervals of time to construct the curve).

learning period than at the beginning. The form of the practice curve doubtless depends largely upon the nature of the learning, and in particular upon its relation to previous acquisitions. If a previously learned movement can be applied without very radical alteration to the new task, progress will be likely to be rapid at the beginning and slow

later on, as the limit of the improvement is approached. If, on the other hand, a radical reorganization of movement is necessary it seems likely that the progress will be slower at the beginning, perhaps increasing later on and finally reaching a point where it slows down again. We cannot say that there is any one universal form of practice curve.

The practice curve shows many fluctuations in ability. The fluctuations in the practice curve may be of a temporary character or longer continued. A sudden drop or sudden rise in achievement may last only for a day at a time or may extend over several days or even over weeks and months. It has been customary to distinguish between minor fluctuations and longer fluctuations in the curve, and to give the name of plateaus to these longer retardations in progress. No such sharp line as this can be drawn, however. We find fluctuations which represent all the degrees between a daily rise or fall in the curve and a plateau. The most general statement which can be made in regard to progress is that it is not uniform, but that every learning curve has its ups and downs. Some of these ups and downs are of very short duration, but others last for longer periods of time. The short time fluctuations are difficult to explain. It seems probable that they are due partly to chance. In some cases different degrees of difficulty in the task itself may account for them, and in other cases changes in one's physical condition or attitude may be the source of the fluctuation. Frequently the learner is not conscious of the fact that he is doing especially well or especially poorly, until he examines his score. It is not possible to connect the good or the bad scores directly with physical condition, or at least the attempts which have thus far been made have not been able to find close connection between physical condition and rate of progress. We must accept these

minor fluctuations as apparently necessary elements of the practice curve, and possibly ascribe them to the great complexity of the factors which influence it. If they are recognized as perfectly normal manifestations we are in a position to avoid becoming discouraged by them.

Plateaus appear in the more complex forms of learning. The discovery of the long time fluctuations or retardations in the practice curve was made by Bryan and Harter in their study of the telegraphic language. It was significant that they found the plateau to exist, not in the process of sending a message, but only in receiving a message. The retardation in progress came in the organization of the perceptual stimuli rather than in the development of the movement of tapping the key and sending the message over the wire. Plateaus have often been found in such complex processes as learning to use the typewriter and learning a foreign language. In ball-tossing and mirror drawing, on the other hand, and in some of the simpler forms of associative learning, plateaus do not appear. Plateaus seem to be particularly prominent in those forms of learning which require a combination of activities, and in which the learning process is in large measure the development of these combinations. Since this process is most largely characteristic of perceptual learning, plateaus can be most appropriately discussed in that connection.

3. *Individual and age differences*

The child is commonly thought superior in sensori-motor learning. It is the common belief that the child is capable of developing skill more readily than is the older person. This belief is found frequently among those whose business it is to teach various forms of skill. One hears it said that in order to learn to play the piano or to use the typewriter, or to play a game such as golf or tennis, with the highest

degree of skill, it is necessary that the earner should begin during childhood.

The child is inferior to the adult in rapidity of movement and steadiness of adjustment. To the disadvantage of the child are certain facts which have been clearly brought out by experimentation. It appears from a study of the rate of movement of persons of different ages that the child is not capable of such rapid movement as the older person. Comparative measurements of children of different ages from six to seventeen years show an increase in the rapidity of tapping of sixty per cent. Similar improvement has been found in the ability to make rapid strokes with the pen. A marked improvement is also found in the ability to maintain the body as a whole, or any part of the body, in a steady position. This has been measured by recording the amount of involuntary movement which a person makes when he tries to hold still. One investigator found that the amount of involuntary movement of the body as a whole is only one fourth as great, and of the finger one sixth as great, in case of the adult as it is in the case of the child just entering school. This increase in steadiness is a very marked advantage in any form of development of skill.

To attain the highest skill, one should begin early; but the child learns more slowly than the adult. Two forms of this question should be distinguished. We may ask first whether children can reach a higher degree of attainment than the adult; or whether a person can reach a higher attainment when he begins as a child than when he begins at a later age. Or we may ask whether a child or an adult improves more quickly in the development of skill. The two questions are not identical. It may be possible that a child can ultimately reach a higher stage of development when he begins early, although he is not able to improve so rapidly in the beginning. It will probably be conceded that in order

to reach the highest degree of ability in motor skill, it is usually necessary to begin during childhood, though there are exceptions to this rule. With reference to the immediate effect of a given amount of practice, however, it is doubtful whether the child can attain as much improvement by the same amount of practice as can the adult.

A controlled experiment with one child indicates inferiority to adults. Since we have not at hand more extensive

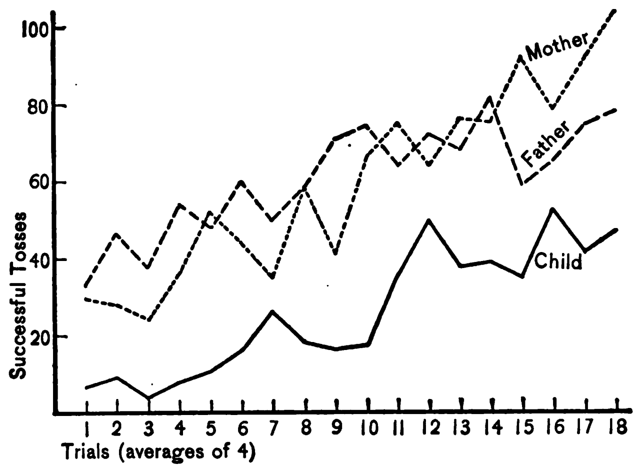

FIG. 14. CURVES OF TWO ADULTS AND AN EIGHT-YEAR-OLD GIRL IN THE SAME KIND OF SENSORI-MOTOR LEARNING

studies in the comparison of children with adults in sensori-motor learning one case may be cited as a bit of evidence. In this study the child of eight years was put through a training experiment in tossing shot into a tumbler. The child's parents also went through the same experiment under exactly the same conditions. All three individuals were interested in the experiment and pursued it with vigor. The accompanying Figure 14 shows the practice curves of the child and

the two adults. The child is observed to be inferior to the adults throughout the practice period, and to improve with about the same degree of rapidity as the adults. At the end of the training period the child was inferior to the adults by about the same amount as at the beginning.[1]

The child's plasticity is an advantage from the point of view of final attainment, and a disadvantage from the point of view of rapid progress. It is common to say that the child has the advantage over the adult because of the fact that he is more plastic. It is necessary to define clearly what we mean by plasticity. It is true that the child has not so many habits of movement as has the older person, and it is therefore probably easier for him to develop habits of a special sort because of the fact that older habits do not interfere with them. Thus, in the case of language, the child has not acquired firmly fixed habits of pronunciation, which interfere with his acquirement of the different modes of pronunciation of a new language. On the other hand, habits which have been learned previously are, in a large measure, the means of rapid learning of a new form of activity. The adult in so far has an advantage over the child, in that he has more habits of control which he can apply to the new situation. It may very well be that the adult can attain more rapid improvement because he has more older habits which can be applied in the new problem, but that he cannot finally attain such a high rank, because of the fact that the older habits are not exactly like the ones which have to be formed in the new task, and that therefore they interfere with the formation of the newer habits. This conclusion would seem to be supported by the fact that adults rarely learn to pronounce foreign languages without an accent.

Plasticity in the child is contrasted with control in the adult. As has just been said, the child is less hampered by

[1] From an unpublished study by Mr. J. F. Gonnelly.

previously learned ways of acting than is the older person. He is capable of doing new and different things more easily. On the other hand, the habit which the adult has already formed may serve as means of control by means of which new habits may be formed. The adult has more control over his activities, and this control is represented by his existing stock of habits. If these habits, which he already possesses, can be readily used in the activity which is to be learned they are of advantage. Since old habits can be used in most forms of learning the adult has in most cases an advantage at the beginning. Since, however, these habits have to be modified, in the great majority of cases, before the new activities can be perfected there is a certain degree of interference between the adult's control and the new activity which he has to develop.

The child's plasticity favors imitation as a method of learning. When the adult sees another person perform a new act he has a tendency to translate it in terms of acts which he himself can perform. He is limited, so to speak, by the vocabulary of action which he already possesses. He may not realize that he is failing to copy the teacher accurately, and this places a limitation upon progress. The child begins without such definite habits of movements and therefore he is in a position to copy more faithfully the model which is set before him. Since the nervous impulse does not have such a pronounced tendency to flow into particular channels, there is greater freedom for the child to develop the channels of discharge which will produce a movement most like the one which he is attempting to imitate.

The child's suppleness is an advantage. The child may have an additional advantage due to the fact that his muscles and joints are more supple than are the adult's. The fact of plasticity mentioned in the preceding paragraph has to do with the connections in the nervous system.

Apart from this type of plasticity, it may be that the child's body is a more pliable tool for the nervous system. It certainly is true that he is more supple and this undoubtedly gives him a certain advantage.

There are wide individual differences. It must be kept in mind that in addition to differences due to age, there are wide differences among individuals. There is a great overlapping between the ability of children of the early and later ages. Many children of six years will have a greater skill of movement than others many years older. These facts have to be taken into account in teaching manual training, handwriting, or sewing, or any other subject which involves the development of manual skill.

TABLE I. THE DISTRIBUTION OF ALL THE FIFTH-GRADE PUPILS IN ONE CITY IN WRITING, WITH REFERENCE TO FORM AND SPEED

Form					
40 and 45	50 and 55	60 and 65	70 and 75	80 and 85	90
5	2	5	1	–	–
9	6	2	–	–	–
20	29	27	14	2	–
30	31	42	8	3	–
38	32	37	12	1	–
29	32	40	12	5	1
17	14	22	11	7	–
1	2	4	1	1	–
–	1	1	–	–	–

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rtance of individual differences may
ht out by reference to the activity of
easure the range and the excellence

of writing of the children of any school grade we will find that they differ among each other to a very surprising degree. Children of the same school grade may vary from the bottom to the top of the scale in form, and from twenty letters a minute to over one hundred letters a minute in speed. The scattering of the children in the same grade and the same school system is brought out in Table I. This table was made up by locating each child with reference to both form and speed. The scores in form are represented by the numbers across the top of the table and the scores in speed by the numbers on the left-hand margin. Thus, if a child makes a high score in form he will be placed toward the right of the table and if he makes a high score in speed he will be placed toward the top. His position will be determined by the square on the table which forms the intersection of the numbers representing his form and his speed. After a tally was placed in this way for each child the tallies were added and their number placed in the squares. These numbers are represented in the table. For example, there were forty children who wrote with a speed of fifty to fifty-nine letters a minute, and whose form was rated at sixty or sixty-five. The startling fact is that we find the children so widely scattered over the various parts of the table, which shows that there are very wide variations in the speed and the form of the writing of this grade, and also in the relation between speed and form. Some children may write very well but very slowly while others write well and rapidly. On the other hand, some children write very rapidly and poorly while others write slowly and poorly.

Training should be adjusted to individual differences. The ordinary school training which gives the same kind and amount of practice to children who differ so widely in their abilities, is an injustice to all of the children except those who are in the middle rank. The study of tables for the fifth,

sixth, and seventh grades, of the sort which is represented here, indicates that twenty-five per cent of the children are already superior in the characteristics of both form and speed to the next grade above them, and that fully forty per cent of these children would be superior in both form and speed to the next grade above them if they had developed these two characteristics in proper balance. There can be no question that much time is wasted in giving these children training which they do not need. On the other hand, the children who are at the lower end of the scale are not profiting as they should by the training which they receive. They require special training either in amount or in kind, and probably in both, to raise their ability to the point which it should reach. It is probably not advisable to attempt to so reduce the differences between the children of the same grade as to bring them all to the same point of achievement. This is an extreme which it would be hardly possible to reach; but a reduction of the amount of divergence which now exists by one half would very greatly improve the present situation. Undoubtedly the same wide divergences could be found in other subjects which have not been subjected to as precise study as has this.

QUESTIONS AND TOPICS FOR DISCUSSION

1. Take a pack of cards containing several series numbered from 1 to 10, shuffle them, and sort them into piles by their numbers. Do not arrange the piles in a regular sequence. Repeat the sorting often enough to acquire considerable facility. Keep a record of the time required for each sorting and draw a curve to represent your progress.
2. Arrange a mirror in front of you on the table so that it will give a view of a piece of paper on the table before you. Place a cardboard or paper screen so that you cannot see the paper directly. Prepare a series of sheets of paper by drawing on them each a square 2 inches in diameter. Place the paper with the square upon it squarely before you and draw the diagonals as rapidly as possible while viewing the figure in the mirror. Keep a record of the time required. Repeat ten times and draw a curve of your progress.

3. Compare the two cases of learning represented above.
4. Is diffusion involved in both examples of learning? If so is it equally prominent?
5. In mirror drawing is coördination with reference to time or force the more prominent? Compare mirror drawing in this respect with dancing.
6. Was the trial and success method involved in sorting cards? In mirror drawing?
7. Compare the rôle of repetition in those cases in which trial and success is and is not prominent.
8. Give two additional illustrations of advantageous good form in learning.
9. In what would attention to the result consist in wood working?
10. Apply the facts regarding the child's inferiority in motor ability.

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"How do you know that you have put him in the right path, anyhow?" inquired the Man with the Red Tie.

"Yes, how do you know that your teaching system deserves to be reckoned as infallible?" asked the Critic; "and how do you know that you have supplied that student with any of the knowledge that would be likely to suit his particular temperament? You have taught him the things you know and you have made him either a copy of yourself or a bitter rebel against your authority; but have you trained his memory? I say you have not. To me the essential of memory training is the development of what powers of observation and selection the student may naturally possess, the cultivation of his instinctive preferences in art, the widening of his outlook upon nature. You do not want to force him to remember your precepts, you ought rather to show him the way in which he can be independent of you and trust to his own taste and intelligence for the mental storing up of the things he wants to know. If you have taught him to think there will not be much the matter with his memory."

"At any rate you will have taught him how to select for himself the things he wants to remember," said the Man with the Red Tie; "and that, I take it, is the best sort of training."

THE LAY FIGURE.

IONS

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sensation, but is the product of development, is shown in those cases in which our form recognition is erroneous. Such cases are illustrated in optical illusions. The Müller-Lyer illusion, shown in Figure 15, is an illustration of this. The two lines which are inclosed in arrow-heads, the one set pointing inward and the other outward, are of equal length, as may be demonstrated by measurement. They appear to the ordinary observer, however, to be very unequal in length.

Our comparison of the length of these two horizontal lines is therefore affected by the presence of the oblique lines. Such

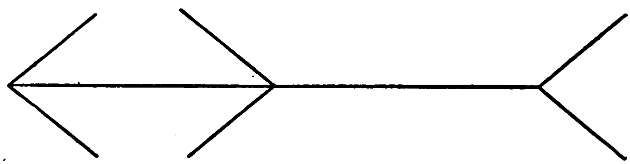

FIG. 15. MÜLLER-LYER ILLUSION

a simple perception as this turns out to be a complicated affair. It has grown up as a result of the early experience of the child. But ordinary experience has not given the training necessary to perfect this particular recognition. By means of special training on this particular point the comparison of length in the Müller-Lyer illusion can be made more accurate. This is done by gradually learning to disregard the distracting oblique lines. This illustration shows that in what we call in ordinary language sensory impressions there is more than simple sensations. There is in such an experience a combination of sensations; and there is added to the sensory impression itself the interpretation which has come from experience. In the more exact language of psychology, such seemingly simple but really complex experiences, which are caused by sensory stimulation, are called perceptions. What in ordinary speech are called sensations, and in technical language perceptions, require training and experience for their development.

In other examples of perceptual learning the interpretation of the sensory impression is a more prominent feature. This is illustrated well in reading, either of words or of musical notation, or of any other symbols such as mathematical symbols. In this case we have to learn, not only to clearly distinguish the form of the object, but also to associate a par-

ticular form with its appropriate meaning. If the child has learned to observe a card with the letter *a* printed upon it, and to pick out from a miscellaneous assortment all of the cards which have the same letter upon them, he has developed a rather simple sort of form recognition. If he has learned to connect the names of the letters with the letters, he has developed an additional type of recognition. But if he can also recognize words, such as *dog*, *cat*, *house* and knows that these printed words represent particular objects in his experience, he has developed an interpretation which is of a still higher sort. It is this sort of interpretation which represents the highest form of perceptual development.

1. *The processes in perceptual learning*

Perceptual learning requires first the discrimination between sensations. In order that an orange and a lemon may be recognized and distinguished, there are certain discriminations between the sensations which we receive from these two objects which must be made. The color of the orange will commonly be distinguished from that of the lemon. This is visual discrimination. The shape of the orange will be distinguished by the recognition through the eye of the round orange as distinguished from the more elliptical lemon. This discrimination in form goes back to earlier experience in handling objects, and has as an important element the experience of running the hand over objects, to gain the impression of their shape through touch, and through the sensation of movement. If one is in doubt as to which object is presented to him he may resort to taste. In any case, the earlier taste experiences form a part of his recognition of the sourness of the lemon and the greater sweetness of the orange. Thus, in this simple distinction between two objects there is involved a considerable number of simple sensory discriminations.

The bearing of sensory discrimination on the more complicated processes may be illustrated further from the field of music. In music the ability to discriminate between the pitch of different tones is essential to the recognition of melody and of harmony. There are some persons who are called monotones, and who are unable to distinguish between a high and a low tone. Such persons very obviously cannot appreciate the chief elements of music. The only distinctions of musical nature which are possible are those of rhythm and of loudness.

Other illustrations of discrimination. One's ability to discriminate between sensations is comparatively easily tested, and experiments have even been carried on in considerable number to test the ability of animals in sense discrimination. One may measure discrimination between sensations of sight, as the different shades of color, or of grays, or the differences in intensity of light. One may measure the discrimination between the length of lines. In hearing, besides pitch discrimination, one may measure discrimination in loudness. This is the test which is ordinarily given for acuity of hearing. In the field of touch one may measure the ability to distinguish between one and two points of contact on the skin. If two points are placed simultaneously on the skin near together they cannot be distinguished, but if they are separated a sufficient distance they can be distinguished as two. The point at which they can just be distinguished as two is called the threshold of two-point discrimination. One may measure the discrimination of strain sensations by testing an individual's ability to distinguish between weights of small difference. One may pursue similar investigations in the field of taste or of smell or of temperature.

Improvement in sensory discrimination as a result of practice is limited. The improvement in the ability to dis-

tinguish between sensations of slight difference appears to be based on two elements. All discrimination as tested in the laboratory depends in the first place upon the subject's ability to understand the directions which are given him, and to pay attention at just the right time and in just the right way. For example, if we are testing the child's ability in pitch discrimination he must know what we mean by a high tone or a low tone. In addition to this he must be able to tell us correctly the result of his observation. If we tell him to report whether the second tone which is given is higher or lower, he must remember the directions correctly and report in accordance with them. Otherwise there may be an error which is not due to his discrimination but to his ability to follow the directions. Finally, he must have his attention focused upon the tones and upon their pitch at just the right instant of time. Certain experimenters who have found improvement to take place in ability to discriminate have ascribed that improvement to the improved ability to pay attention to just the right element of the stimulus. In addition to this improvement in the ability properly to meet the experimental conditions it is possible that there may be some improvement in the sense itself. In the case of a mature person it is very doubtful whether there is improvement of this latter sort as a result of training. There is possibly more improvement with age on this score, though even this is denied by competent investigators. This conclusion is borne out by the fact that one's highest possible ability in sense discrimination may be reached with a comparatively short period of training. This improvement may be rather large if one has not been accustomed to practice in discrimination, and in reporting the results of his discrimination; but a fairly definite limit is likely to be reached rather soon. As we shall see later, this is reached at different points by different persons; and it appears

to be fairly definitely fixed by the nature of the sense organs.

Sensory discrimination is a subordinate element in the higher forms of perceptual learning. We may recur to the illustration of music. While pitch discrimination is an important element in the appreciation or production of music one may have a high degree of pitch discrimination with little or no musical ability. Fine discrimination of colors is undoubtedly necessary to the painter or to the art critic; but mere color discrimination is not sufficient for one to distinguish between good and bad color harmony, or to judge the composition of a picture. There are perhaps a few occupations in which a very high degree of sense discrimination is the chief requirement. It is probably true that this is the chief requisite for a tea taster. In most occupations, however, a very high degree of sensory discrimination is not required; and even in most of those in which fine discrimination is necessary or desirable it is not the most important element.

Training in sensory discrimination is acquired for the most part incidentally. The musician does not set himself to long periods of practice in distinguishing different tones. He acquires the ability to discriminate finely between tones, but he does so as a consequence of his other training. The violin player acquires this ability in tuning his instrument, and in paying attention to discover whether his own instrument is in tune with others. The painter does not give himself formal exercise in distinguishing or matching colors, but gets his training in attempting to match the color on his painting with that of the object which he is trying to represent. The blind person develops his extremely fine discrimination of touch by learning to recognize different objects or to read the Braille print.

Furthermore, what we often ascribe to high ability in sense discrimination is really ability in interpretation. Thus

the fact that the sailor can recognize land before the landsman is not due to the fact that his eyes are keener, but to the fact that he knows what signs to look for and knows the meaning of the signs he sees. The ability of the woodsman to follow the traces of an animal or a human being through the forest is due to his ability in observation rather than to his ability in sense discrimination. He knows where to look for the broken twig or the faint foot-print, and he knows what these signs mean.

The value of specific drill in sensory discrimination is therefore limited. The facts which have been mentioned all point in the same direction. We have been told recently by certain educators that the most important type of training that can be given the young is development of keenness in sensory discrimination. In application of this general principle exercises have been devised for the purpose of training discrimination. Such formal exercises run the risk of entailing great waste of time. A small amount of formal training properly devised to give the child just the kind and degree of ability which he will need in some more complicated form of learning may be of value. But unless the training is limited in this way it is likely to produce mere keenness of the senses without the ability to use this keenness in better understanding or control of the objects of the physical world. What the child needs is a wide acquaintance with many sorts of physical objects, and the sort of experience with them that will enable him to know what they mean. When the practical demands make it necessary that he should have a higher degree of discrimination than he possesses, this motive will stimulate him to acquire incidentally training which will be sufficient for his needs.

The second process of perceptual learning is the combination of sensations into perceptions of objects. We very rarely, if ever, experience single sensations. A sensa-

tion always stands to us as the sign of an object; and if we analyze objects we will see that they represent whole groups of sensations to us. When the child picks up his rattle, he also sees it, and hears it, and gets movement sensations in waving it, in addition to the touch sensation in handling it. Any one of these sensations will at a later time call to his mind, more or less clearly, the other sensations which he has experienced from the same object at the same time. This combination of sensations which come from the same object is called in technical language complication or fusion. It takes place at a rapid rate in the early months and years of the child's life. There is a period in which the child has not learned to connect the sight sensations which he gets from objects with the touch sensations which he receives in handling them. The closeness which this fusion finally attains is well illustrated in the size-weight illusion. If two bottles or boxes which are very different in size, but the same in weight, are lifted simultaneously the smaller object appears to be much the heavier. This is because we have learned to make a vigorous movement in lifting a large object, and we therefore lift the large object so much more energetically than the small one that it appears light by contrast. The chief point at which this matter of complication is of interest for later learning is in the recognition of form. Form recognition is susceptible of a large degree of development, even in the case of the average mature person. We commonly think of the recognition of form as based altogether on sight. Sight, however, is in this matter largely a means of representing the experiences which we have previously had in touching and in moving our hands and eyes over an object. The earlier recognition of form which is obtained through experiences of touch and of movement is the more fundamental, and the later sight experiences serve to revive or to represent these.

The recognition of form is complex and subject to indefinite development. The features of learning to recognize a new or complex form are illustrated in drawing a complicated figure. In the beginning one has only a vague and indefinite idea of the figure that he is to draw. He has a general comprehension of its shape, or he may, if his type of mind is of another sort, see more clearly a few more isolated details, but he fails to combine the comprehensive view and a clear recognition of the parts. If we study the process by which he attains this clear and comprehensive view we discover a number of significant facts. In the first place, the process in general is not one of merely receiving passively an impression. The figure is not, so to speak, photographed on one's mind, but one proceeds in an active way to the exploration and study of it. This activity is well brought in the manner in which one learns to draw a series of lines which are arranged in a generally horizontal direction. The study and drawing of such a figure is almost universally begun at the left hand end. So far as the impression itself is concerned, there is no reason why the right hand end should not be developed as early as the left end; but the habit which we have formed of beginning at the left end in reading and writing undoubtedly influences us in the study of such a figure. Previously formed ideas are also actively used as well as previously formed habits. If the figure is of a nature which permits, the lines which compose it are likely to be counted. This means that the idea of number is employed. Further, the angles which are formed by the lines are likely to be estimated, and the lines themselves are classified according as they are straight or curved. Their length is noticed, and the other characteristics which we have learned to observe because of our previous knowledge and the customary classification of different kinds of lines and of figures. Through this active process, in which previous

habits and ideas are used, we finally come to a cleared-up recognition of the figure as a whole. We commonly fail to pay attention to the manner in which we arrive at this later and more complete comprehension. It appears to us to be a simple matter of impression, and we therefore fail to understand that the development of ideas of form is really complex, and dependent on our previous training and preparation.

The recognition of form is dependent on movement. It has already been incidentally mentioned that the combination of sensations which enables us to recognize the forms of objects is brought about by means of movement. After we have made a detailed exploration by running our hands around the borders of objects, or by folding our hands over them, or running our eyes about the outline, we learn to recognize familiar objects by the particular picture which we get from one particular view of them; but it is apparent from the way in which we learn to recognize new forms that this later stage is based upon an earlier one in which a study was made part by part by the use of movement. The value of movement in the study of form is well brought out in the process of learning to write. In his early reading the child may get a preliminary and rough idea of letters from looking at them. Even here he uses eye movement, but the movement is not so precise or detailed as when he is required to make a more minute examination for the purpose of writing. The act of guiding the pencil so as to produce the forms of the letters gives the child a much more minute and detailed recognition of them than he has previously had. If an adult is asked to study a new form with a view to drawing it, he will commonly be seen to make a tracing of it in the air, while he is studying it, in order to reinforce the impression which he gets through his eyes, by the experience of hand movement.

Form is usually studied for purposes of understanding

and appreciation. We see illustrated in the development of the recognition of form a principle which is similar to that already mentioned in connection with sensory discrimination. This principle is that the perfection of the ability in question is sought in the main with some purpose in mind which goes beyond the development of the activity itself. We do not ordinarily find persons going about comparing and studying various forms just for the purpose of comparing, classifying, and remembering forms by themselves. If we did find such a person we would be inclined to be suspicious of his intelligence. What we do find them doing is comparing the shapes of different leaves so as to get a clue as to the kinds of trees which they grow upon, or comparing the shape of the branches, the way they are joined to the trunk of the trees, etc. We find persons comparing the shapes of land formations in order to trace them to their origin, and to learn how the forces of wind and rain and of the shrinking of the earth or the changes in the interior have produced the superficial forms upon the earth's surface. Or if we find a person who is apparently absorbed chiefly in the study of form for its own sake, we soon discover that it is not the form itself that he is interested in but rather its beauty or its ugliness. He is not interested in forms of all kinds but rather in the forms which are symmetrical and pleasing in appearance. The recognition of form is largely incidental to the satisfaction of other motives. If we may apply this principle to the work of the school, we may say that the most effectual teaching of form to the child is that which he gets when he is trying to identify objects, to represent them for purposes of record or of communication, or to discover beauty in them.

The last type of perceptual learning is concerned with the recognition of the meaning of complex symbols. This process of the interpretation of the meaning of complex symbols is illustrated in a variety of forms of learning. It appears in

learning a language, both oral and written, in learning to interpret the telegraphic language, and stenographic signs, in learning to read music, and in the understanding of mathematical symbols. In all of these cases the recognition of the elements is only a step in the completer recognition and interpretation of the complex object. In the case of those sorts of meaning in which vision is the sense employed the recognition of form is only a minor element. In all of these forms of recognition the combination of the elements is a very important feature. In oral language, for example, the number of the separate, individual sounds is not great. The number of the possible combinations of these sounds, each of which has a definite meaning because it represents a word or a group of words, is enormous. The same, of course, is true of printed language. The elements and the combinations of these elements are represented in a similar fashion in mathematics. The separate digits each represent a definite number, but they may be combined in an indefinite variety of ways. The learning process in this phase of perceptual learning, then, does not consist merely in simple associations between perceptual elements and ideas. It is rather the ability to recognize the various combinations which may be formed, and the apprehension that certain meanings belong to groups of elements because of the manner in which they are combined.

The combination of elements makes possible an increase in the range of attention. The number of objects which one can include in his attention span when these objects are not related to one another so as to form an organized group is rather small. It has been found by experiment to be about five to seven. When these objects are combined, as in the letters of a word, or in the grouping of dots into patterns, the range is greatly increased. One may be enabled to recognize accurately fifteen or twenty letters in a word or group of

words, as compared with five or six letters which are not thus grouped. This effect of organization is much the same as was mentioned in connection with sensori-motor learning. It is well illustrated in the experiences of one who learns the telegraphic language. In the early stages he is able to receive a message over the wire only as rapidly as he can recognize the individual letters. As he becomes more expert, he begins to combine letters into words, and finally reaches the point where he does not pay attention to the individual letters but allows them to group themselves into words or phrases. Thus he enters upon the process of what is called reading behind. His attention at any moment is upon the material which came over the wire some seconds earlier. If he finds that a series of numbers is about to be given, which cannot be organized in the same way as letters, he finds it necessary to catch up in order to be able to apprehend them. This increase of the range of attention through the arranging and organizing of the elements to which we pay attention is a very important condition of efficiency in learning. The improvement of one's span of attention for isolated objects is very limited, just as is the improvement in mere sensory discrimination. A much higher degree of improvement in the span of attention for organized elements, however, as in the case in reading, is possible, and necessary if we are to reach the higher levels of ability.

Different degrees of grouping may form hierarchies in recognition. The significance of different degrees of grouping of objects which are presented to sense, and the meaning of these different levels for progress in learning, was first pointed out by Bryan and Harter in their pioneer work in the study of the telegraphic language. These investigators discovered that, in the process of receiving a message over the wire, the progress in ability did not take place steadily, but that after considerable ability had been attained, there en-

sued a period of little or no progress, which they termed a plateau. As a result of their study of the plateau they concluded that the earlier more rapid rise, shown in Figure 16, was due to the development of the recognition of the simpler elements, and that the plateau represented a period when the group recognition was being developed. The later rise came

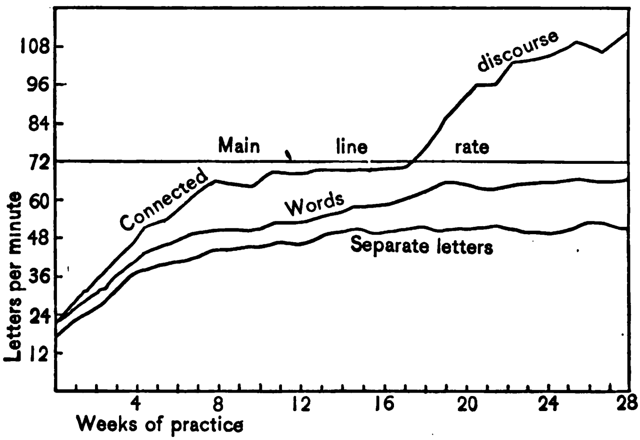

FIG. 16. ANALYSIS OF THE PROCESS OF RECEIVING IN TELEGRAPHY INTO RECEIVING SEPARATE LETTERS, DISCONNECTED WORDS, AND CONNECTED DISCOURSE

(From Bryan and Harter's *Psychological Review*, vol. VI, by permission of the publishers.)

when this group recognition was developed to such a point that it could be carried on with ease. Whether this is the only or the chief explanation of plateaus we shall consider in a moment, but that the development of these higher order habits, as they are termed by Bryan and Harter, is an important feature of learning cannot be doubted.

Plateaus due to a separation of different orders of habits may not be necessary. There can be no doubt that this distinction between the higher and lower order habits holds for many cases of learning, and that the separation of these

different habits may result in a delay in learning which is indicated in the curve by the plateau. Later investigators, however, among them Swift and Book, have shown that such a plateau, while very frequent, is not absolutely necessary. They point out the fact, which was recognized by Bryan and Harter themselves, that the higher order habits begin to be formed in the early stages. They go further than this and assert that the development of these higher order habits can proceed sufficiently in the early stages so that it is not necessary that there should be a cessation in progress due to a separation of the lower and higher order habits. To substantiate this conclusion, curves of progress have been obtained in which no such plateau appears.

Various causes may prevent progress to a higher stage. Plateaus may be also caused by other conditions than the imperfect automatization of the lower order habits. It frequently happens that the learner fails to progress beyond a certain point because he rests satisfied with his attainment at this point, and does not make sufficient effort to progress beyond it. The failure to make the effort may be due to lack of confidence that further progress is possible to him, to a lack of knowledge how to go on to a higher stage, or to mere laziness and unwillingness to make the attempt. In any case the learner fails to learn the higher habits or the more efficient ways of performing the task. An illustration may be taken from footing up columns. There are simple and primitive modes of adding, and there are more efficient and more complex ways. One may add one figure at a time, going through the process of naming the figures that are added and the sum which is reached; or he may progress to a higher stage by merely naming to himself the sum and leaving out the naming of the numbers which are added; or he may progress to a still higher stage by making several additions at once and then adding these. This stage is reached by devel-

oping the ability to apprehend combinations of figures as a total sum, rather than as individual numbers to be added separately. A still higher stage, which would not be reached by the ordinary worker, is the ability to add two or more columns simultaneously. The probability is that very many book-keepers and other workers remain at a lower stage when it would be to their interest to progress beyond it.

Plateaus may be caused by undue haste. Another reason for a delay in improvement is the attempt to hurry too much. In this case the learner unduly speeds up the lower order habits before the higher order habits have had time to form. Retardation in progress is caused by this undue haste, or injudicious spurting. When the activity is forced the whole habit is disorganized. If, in typewriting, one attempts to write more rapidly than his ability at the time warrants, he makes a large number of errors and becomes confused. He connects a letter with the wrong key and when he sees the letter again he has the impulse to press the wrong key instead of, or in addition to, the right one. This is what is meant by saying that the habit becomes disorganized.

A plateau may be caused by the necessity of breaking up habits which are formed in the early stages. It is probable that if a person learns without expert instruction or guidance he will fall into methods of performance which are not the best from the point of view of the development of final skill. It may be that even under expert guidance one inevitably falls into habits which are the best possible while he possesses a moderate degree of attainment, but which are an impediment to the highest skill. In such cases it may be necessary to pause in the onward progress to break up these habits before further advance is possible.

The development of the higher forms of recognition is usually dominated by certain active responses. As in the case of sensori-motor learning we found that there must

always be a stimulus to which the response was made, so in perceptual learning we find that the stimulus is developed as a means to a response which may be remote or immediate. In some cases it is clear that the response itself has an active part to play in bringing together or organizing the elements of the recognition. This is brought out, for instance, in the study of reading. The elements which compose a word are not brought together simply because they belong together in our perception, but they go together because they represent a spoken word, and the spoken word is a unit of response. The difference between a collection of figures making a large number and a collection of letters making a word indicates this. If collections of figures were represented by single spoken words there is no reason why they might not be recognized as easily as words themselves. But, as a matter of fact, the limit for the span of attention for figures is about the same as that for disconnected letters, and is about a third to a fourth of the span for words. The development of an organized recognition of a group of stimuli, then, will be promoted whenever we can find an appropriate response which corresponds to the organization of the elements presented to sense.

The higher habit makes greater rapidity in the simpler acts possible. When the higher order habits are formed, the lower, simpler acts are performed more rapidly without causing confusion. A whole series of movements has become associated together so that the performance of one leads to the next without the necessity of thinking of it as a separate act. The series of movements is made as a response to one idea rather than to the recognition in detail of a series of separate stimuli. In handwriting the child at first learns to make each letter for itself by responding to each letter or stroke as a separate stimulus; but as his habit becomes organized he progresses to the higher stage in which the

thought of the word sets in motion the whole train of movements by which it is written.

A balance must be kept between the effort to advance and to perfect the simpler processes. While the caution against overhaste in the simpler habits, before the higher ones have been formed, is not opposed to the advice that the formation of the higher habits be not unduly delayed, the overemphasis of either of these two rules is apt to lead to the neglect of the other. Unduly prolonged attention to the simpler habits, in the effort to avoid haste, leads to delay in forming the higher habits. Similarly, the effort to form the higher habits early will, if overdone, lead to overhaste in the simpler habits. Therefore a certain balance between the perfection of the lower habits and the progression to the higher habits must be maintained.

Plateaus in learning a language may represent real but hidden progress. When the learning consists partly or wholly in acquiring information, or in learning facts, a plateau may be caused in still another way. In learning a foreign language part of the process consists in acquiring the meaning of the various words of the language, and part in gaining a familiarity with the sentence structure, inflections of various parts of speech, etc. When one begins the study of a foreign language, he acquires the meaning of some of the more familiar words, and the ability to understand the sentence structure and some of the more common constructions. This acquisition produces a very rapid improvement at the beginning. After he has gained familiarity with the more frequently recurring words and types of syntax, because he meets them frequently, the learner comes in contact with a large number of words and a certain number of grammatical forms which are of less frequent occurrence. Progress then is slower and may even cease altogether for a time, so far as the score made in the perform-

ance goes, because that which is learned in one period of study may not appear in the next one, and also because any one fact is not repeated frequently enough to be learned economically. After this larger number of new facts have recurred with sufficient frequency, practice upon them begins to tell on the score and rapid progress is again made.

A knowledge of the meaning of plateaus may make it possible to avoid them or may prevent discouragement. Because of the difference in the kinds of plateaus or in the conditions which cause them, we cannot make general statements which will apply to them all. We cannot say that it is always possible to overcome plateaus, nor can we say on the other hand that they are always necessary. They are of very frequent occurrence in learning curves, and they frequently cause discouragement to the learner. A knowledge of the cause of the plateau, and of the fact that it is frequently not a sign of lack of progress, will help in acquiring a better attitude of mind toward it. The knowledge of the way in which plateaus are sometimes needlessly caused will also enable one in such a case to diagnose the difficulty and to overcome it.

2. Development in perceptual learning with age

Sensory discrimination does not develop greatly with age. The facts in regard to the development of sensory discrimination with age are not entirely clear. In the case of pitch discrimination, some competent investigators, such as Seashore, hold that there is no important increase in the child's ability after early childhood. Others report large improvement with age. The development which is found by these other investigators may be due to the increasing ability of the child to adapt himself to the directions of the investigators, and to properly direct his attention to the task. If this development is allowed for, it seems that pitch discrimination

develops to its full degree in early childhood. Discrimination between weights appears from Gilbert's investigation to increase markedly with age, and this was included as one of the tests in the Binet-Simon series. The same explanation may perhaps be given for this development, however, as for the apparent development in pitch discrimination. Plausibility is furnished this explanation from the fact that in another sphere the child commonly does better than the adult. This is in the discrimination between two points on the skin. It is possible that this superiority is to be accounted for by the greater closeness of the nerve endings in the child's skin, and by the fact that his skin is softer than the adult's. But whatever the explanation the result indicates that discrimination is not one of the mental processes which develop greatly with age. This bears out the conclusion which was arrived at earlier in the chapter that discrimination alone is not a very significant mental process. Ability to discriminate between colors among children of ordinary training develops gradually up to the age of seventeen, but a good degree of color discrimination may be developed in young children. Auditory acuity also develops, but this may be due, in large measure, to the development of other structures in the ear than the neurons.

The child's development in form recognition is dependent upon both inner growth and training. Soon after the child enters school he possesses the ability to apprehend and to reproduce very simple figures. There is little improvement during his school career in this simple type of recognition. The recognition of more complex forms, as shown by his ability to draw, does develop greatly during his school life.

During about the first two grades the child's drawing is a sort of symbolic sketch, representing some of the marked characteristics of the general class of objects to which the

particular thing he is drawing belongs, but not the features of this individual thing. He gradually introduces these individual features until his drawing begins to look like what he is trying to draw. By the time he reaches the grammar grades all the parts of his drawing are copied directly from the object he is representing. Still, the drawing is only in silhouette. No solidity is shown. If the child receives no training, or if the training is poor, the child is not likely to advance to the representation of perspective. Besides this, the fullness and accuracy of the drawings at the earlier stages depend on the quality of the instruction. While the child's recognition of form is undoubtedly advanced beyond his drawing ability, yet the advance in drawing does indicate an advance in recognition.

The appreciation of beauty in form appears to depend still more largely upon age. Even young children, who can be trained to reproduce forms pretty faithfully by drawing, do not yet appear to develop the sense of beauty in form in the earlier years of their elementary-school life. One of the six-year-old tests in the Binet-Simon series requires the child to distinguish between pairs of faces, one of each being ugly and the other passably good looking. The typical five-year-old child does not recognize these very marked differences in beauty. Form to the young child is a means of recognizing or expressing meaning but is not a means of gaining or of giving æsthetic satisfaction.

The development of perception in reading may be almost fully completed in the primary grades. It would be incorrect to say that the child reaches the highest possible degree of development in reading in the early grades. The development in reading depends upon other elements than that of perception alone. The child may be retarded in his reading ability, not by his inability to recognize words, but by his inability to understand the meaning of these words. So far

as perception is concerned, however, we are dealing with the more mechanical phases of reading and not with the corresponding thought processes. On account of the thought requirements of reading it will show progress as long as the person is developing intellectually. But the child in the third or fourth grade reaches nearly his full ability in the simple recognition of words.

The facts which have just been presented would lead to the view that so far as many of the simpler features of sense perception are concerned the chief development takes place rather early. There is another aspect of the child's perception which is rather later in its development and which we may call the control of his perceptions or observation.

Observation and report show improvement throughout childhood. The ability of a child to direct his observation toward the significant features of a scene or a picture which is presented to him, and to report faithfully and accurately what he has observed, requires a control of his attention which goes beyond the recognition of simple forms, or single objects. There are two aspects of situations which children appear to observe about as well as adults. The first of these is action, and the second, number. They observe action as well as older persons because this is apparently what attracts their attention. They observe number as well as adults because adults are very poor themselves in observing this feature of their environment. In other respects there is a large increase in ability as the child grows older. The improvement in the recognition of the color of objects, or of their position, is marked. The child's report of what he has observed becomes fuller as he grows older. The details which a young child does observe and report are also less connected and organized than those reported by the older person. The older child or the adult observes the meaning of the objects in a scene, while the younger child simply

enumerates the objects. The development of the older child may be described as consisting in the control or the organization of his perceptions, rather than in the development of the simpler processes themselves.

The child exhibits a large amount of suggestibility. Another aspect in which the child's defectiveness of control is shown is in his suggestibility, which has been reported on over and over again by different investigators. This feature of the child's mental life has already been commented on in the discussion of imitation. We may here add another illustration. One of the common means of investigating a child's ability of perception is the presentation of pictures, or of groups of objects on a card. A child may often be induced to report that he saw objects in a picture which were not there at all, by the appropriate type of questions. In the experiment by Binet a card was shown to the child on which was a button fastened to the card by means of glue. If the child is asked how the button is fastened, he will often say that it is held by means of thread, and if the matter is pursued he will describe the color or the size of the thread with a good deal of minuteness. The great danger which arises from this fact of the child's nature is, that the teacher may believe that the child is getting intellectual training when he is not. To induce the child to give judgments on intellectual questions in a parrot-like fashion, which he has simply reflected from the teacher, gives him no intellectual training whatever. Except in those cases in which the teacher is deliberately attempting to build up a particular belief or sentiment in the child's mind, it is necessary to be very much on guard against using leading questions, or influencing the child in the independent pursuit of his own judgment. The child, of course, requires great assistance in making his judgments. The material must be furnished him, and his attention must be called to particular aspects of the material.

In this sense the teacher influences the formation of the child's judgment. But the goal of teaching should be the development of as great independence on the part of the child as possible; and both the child and the teacher should learn to recognize the difference between those cases in which he thinks for himself and those in which he copies the thought of another.

TABLE II. PITCH DISCRIMINATION OF 166 CHILDREN, AGED 6–15 YEARS (SEASHORE)

No.	*Limen in vibrations per second.*
20	1 to 2
63	3 to 5
48	6 to 10
21	12 to 30
14	over 30

There are large individual differences in all phases of perceptual ability. Differences of large degree have been found in studies of discrimination, in the development of the recognition of form, and in the more complex processes, which may be represented by the various phases of reading. Differences in discrimination may be represented by the results of the study of pitch discrimination. In Table II are shown the differences found by Seashore from a study of one hundred and sixty-six children. This table is to be read as follows: There were twenty children who were able to discriminate differences of pitch of one to two vibrations; sixty-three children could discriminate differences of from three to five vibrations; and there were fourteen children who could discriminate differences of over thirty vibrations. In some other forms of discrimination the differences are not as extreme as this, but in all cases which have been investigated they are large enough to be important. In an experiment with a group of adults in learning to draw

a figure, which was composed of eight straight and curved lines in a somewhat complex arrangement, the slowest of the group required ten trials and the fastest only two trials to correctly draw the figure. These two are not isolated cases. The other individuals were scattered fairly uniformly between these two extremes. The distribution of sixty-five individuals according to the number of trials they required is as follows: —

Trials	2	3	4	5	6	7	8	9	10
Individuals ..	4	10	17	11	11	5	1	3	3—65

In Table III are shown the differences in the rate of reading, and in the ability to apprehend words seen in short exposure of a fraction of a second, among a group of adults. It will be seen that the slowest reader in this group took three times as long to read the same amount as the fastest, and that the average of the fastest five readers read over twice as rapidly as the average of the slowest five. In the other column, which represents the apprehension of letters or digits during brief exposure it appears that the individual with the narrowest range of attention apprehended less than half as many letters or digits in one exposure as the individual with the widest range.

Training must adapt itself to these individual differences. Every investigation in which the differences between the individuals are measured shows similar variations to these. Moreover, these differences cannot be ascribed in the main to differences of practice, because when a group of individuals is subjected to the same degree and amount of training it appears that the differences which exist between them at the start are fully as great after training as before. In some cases the aim of training should be to equalize these differences, and in other cases to emphasize them by giving special training to the child who has the greatest ability. If the

TABLE III. TYPICAL INDIVIDUAL DIFFERENCES AMONG ADULTS IN RATE OF READING AND THE AMOUNT APPREHENDED DURING A SINGLE BRIEF EXPOSURE (SPAN OF ATTENTION)

Rate of reading in words per second

	Individual	*Rate*
	1	6.9
	2	5.5
	3	5.5
	4	5.3
	5	4.7
Average of first 5		5.6
	6	4.7
	7	3.9
	8	3.7
	9	3.5
	10	3.3
	11	3.2
	12	2.9
	13	2.9
	14	2.9
	15	2.9
	16	2.9
	17	2.8
	18	2.7
	19	2.7
	20	2.7
	21	2.2
Average of last 5		2.6
Average of all		3.7

Average number of digits or letters recognized per exposure

Individual	*Number*
1	7.9
2	7.8
3	7.3
4	7.0
5	6.7
6	6.6
7	6.1
8	6.0
9	5.9
10	5.8
11	5.3
12	5.2
13	4.8
14	4.5
15	4.3
16	4.1
17	3.8
18	3.1
Average	5.7

aim is to equalize them, training must be given in very different amounts to the different children. Those who possess a high degree of ability must be allowed to omit special training, and those who possess a low degree must have

an unusual amount of training. When a child is weak in one phase of mental activity and strong in another he probably ought in most cases to be given more than the usual training in the ability in which he is weak. In the case of the young child, at least, it is not desirable to encourage a high degree of specialization. This may be more appropriate later on. Where a child is strong in all kinds of mental work he ought to be allowed to progress more rapidly than his slower fellows to the higher levels of learning.

QUESTIONS AND TOPICS FOR DISCUSSION

1. Find some other illustration of an illusion which shows that our perceptions are determined by something beside the simple sensory impression.
2. What forms of discrimination are involved in the completest recognition of a lead pencil, an apple, a word?
3. Could the child be given a high degree of training in sensory discrimination and still have a very narrow experience? Explain your answer.
4. Compare the apparent weight of a piece of iron or lead and a much larger pasteboard box by lifting them. Add to the weight of the box until the two objects seem to be equal in weight. Then weigh the two and report and interpret your finding.
5. Draw a figure which has a somewhat intricate system of lines and draw a star at one side. Show the figure to another person for twenty seconds asking him to look fixedly at the star during the whole time and afterwards draw it. Perform the same experiment with another person without requiring him to fixate the star. Interpret the results.
6. Flash before another person a card on which are eight spots arranged irregularly and another on which are eight spots arranged in two regular groups of four each. Interpret the results.
7. Formulate a set of rules for dealing with plateaus.
8. Why does the appreciation of beauty of form develop later than simple recognition of form?

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CHAPTER X

ASSOCIATION AND MEMORIZING

1. Memory, perception, and habit contrasted

Perception and memory both depend on past experience. In the description of those forms of learning which involve chiefly the development of perception, or of the better recognition of the stimulus, we saw that the past experience is of great importance. In fact, the meaning which a person gives to the sensation that is produced by the stimulation of a sense organ by a physical object, exists only because he has had previous experience with the object, or others similar to it. We saw, further, that the meaning which an object acquires in perception is not distinguished in the mind of the perceiver from the sensation which he gets from the object. Indeed, one is very often unable to distinguish between the interpretation which he gives to the sensation and the sensation itself. In memory [1] we have also an example of the effect of past experience upon the experience of the present; but, in this case, we are definitely conscious of the fact that part of our experience is derived from what we have experienced before.

An illustration. In both immediate interpretation in perception, then, and in memory, our responses depend upon experiences which we have had in the past. An illustration will make clear the difference between these two modes of

[1] Memory, in the restricted sense, is living over again previous experiences and placing them more or less definitely in our past life. In the broader sense memory is the correct reproduction of previously formed associations, whether they are associations between ideas, or between stimuli and movements.

response. The animal is affected by past experience so far as his attitude toward objects is determined by the immediate interpretation which is characteristic of perception. A chick will learn to discriminate between an edible worm and one which is not edible, as a result of having experienced the bad taste of the one and the good taste of the other. A chick will at first peck at any sort of worm, but when it gets one which is distasteful, it rejects it. After one or more experiences of this sort, the tendency to peck at the distasteful worm is restrained. We may assume that in this case the worm acquires such a character to the chick that it immediately dislikes it on sight. It does not recall that it tasted the worm in the past and that it did not taste good, but rather has a disgust for the worm without realizing why it is disgusted.

Contrast with this the case of the human being who has acquired a similar distaste for some article of food, due to the fact that this particular article has made him sick. The immediate attitude of disgust is the same in the two cases, but the human being is likely not only to reject the food, but also to ask himself the reason for his dislike. He may then recall the circumstance of eating the food and the resulting illness, and thus be able to explain his feeling attitude. The chick's experience is probably a matter of perception merely; the human's experience may include memory.

A series of movements is designated memory when the movements represent ideas. The dependence of habit upon past experience is evident in the very definition, or the simplest description of a habit, since a habit is a mode of activity which is acquired and gradually perfected through the repetition of an act. Memory is sometimes used in a broad sense to include habits, as when we say we remember how to skate or to swim. But in the narrower sense, in

which memory is distinguished from such sensori-motor forms of learning, we apply memory to an habitual chain of movements only when they represent a series of ideas, as in the case of repeating the alphabet or the multiplication table, or a poem.

Memory distinguished from perception and habit. In brief, there are two forms of the survival of past experience, which are similar to memory in the fact that they are due to the more or less permanent results of experience in the formation of systems of connection among the neurones of the nervous system, — namely, perception and sensori-motor habit. With these are contrasted two other forms of survival of past experience, to which we give the name memory. The first form of memory is the revival of a previous experience, together with its location more or less definitely with reference to other experiences which make up our notion of our past life, as when we remember our last year's vacation. The second form is the repetition of a series of associated ideas, together with the acts which correspond to them, in the order in which they have been previously learned, as when we repeat the list of the presidents of the United States in order.

2. Memory and association

Memory of the first type is a case of association. It will readily be seen from the illustrations used, that memory, which consists in the recognition and placing of past experience, is based upon the recall of ideas which have been previously associated with the object or idea which is presented to the mind, and which serves to explain or give meaning to the present experience. The meaning in this case does not, as in perception, seem to belong to the thing which is the object of our attention. It rather arises from the fact that the object calls up other ideas with which it has been con-

nected previously. Memory of the first type may then be said to be a case of association [1] of ideas.

Memory of the second type, or memorizing, is the formation of associations so that they may be reproduced at a future time. Memory of the second type is obviously a case of association of ideas. It is concerning this type that the laws of efficient memorizing have been developed. When a student memorizes a poem, for example, he is making associations between the successive words of the poem, and also between the words and the ideas which are expressed by them. In a similar way, in learning a vocabulary he is forming associations between English words and their meanings and the corresponding foreign words. Memorizing thus means the formation of associations in such a way that at some future time when certain of the associated ideas are attended to, the others will be called up also. We call such mental processes memory, not because they recall to us the idea of a definite experience and of a time when we had this experience in our past life, but rather because they reproduce in our present experience something which is very similar to that which we have experienced previously.

The associations of memory differ from other associations in the fact that a standard of correctness is applied to them. We may get further insight into this type of memory by comparing the nature of the association which is involved in it with other sorts of association. When an idea occurs to our mind, it may call up a variety of other ideas, and from the point of view merely of association they may be all equally appropriate. The idea "house," for example, may have associated with it, and may therefore call to mind, ideas of other kinds of building, or ideas of different kinds of houses,

[1] Association is the process by which one idea calls up another. Ideas may be associated because they have been associated in the past, or because they have some logical relation.

or of the contents of a house, or of the people who dwell in houses, and so on. These would all be equally cases of association; but if our purpose is to recall a particular association which has been previously formed, as for example, "The house that Jack built," we bring to bear on this association a form of judgment which we have not brought to bear on the others. We then raise the question whether the particular association which has occurred to us is one which has been formed with this word in the past, and which it is our purpose to bring up again. We bring to bear upon the association in this case the question of its correctness or incorrectness, according as it corresponds or does not correspond with a particular previously formed association. This, then, is the type of association to which we refer under the term memorizing. Memorizing consists in forming associations, so that at some later time we may reproduce the same ideas in the same sequence in which they originally existed.

Association is also the means of recall. To call memorizing the formation of associations throws light also upon another matter, namely, the means by which we are able to recall what has been memorized. Just as memorizing consists in the formation of associations, so recall consists in the reproduction of an idea through its association with another. A typical case of recall is illustrated when we are thinking of a person's face and attempt to recall his name. In this case we attempt to reproduce the association between the face and the name, which has been previously formed in our mind. In the same way when we attempt to recall a poem, having in mind the title, we attempt to associate the first line, and the second line, and so on in order, with the title; or we have in mind certain phrases in the poem, or certain of the ideas which are expressed in it, and we attempt to associate with these the words in their correct order.

Most apparent exceptions are not genuine. It may some-

times seem that ideas are recalled to mind independently of this process of association. Ideas sometimes seem to pop into the mind; but the usual explanation of such cases is that the association is not noticed by us. We find a tune running in our head, and do not know what caused the appearance of the tune. The cause has merely escaped our notice, as may be shown by a simple experiment. We may start a person humming a tune by ourselves humming or whistling it, although the subject of the experiment himself is not aware of the cause of his own action.

This fact that recall is a matter of association has important practical bearings. Since recall is based upon association it is dependent upon the formation of the appropriate association in the first place; and it is necessary, in order that recall may be accurate and ready, that the association be properly formed. This principle means further, that, in attempting to recall anything, the method to pursue is not to try to force the idea into the mind blindly, so to speak, or to try in a random manner to bring up the idea; the better method is to call to mind the ideas which we know to have been associated with the one which we wish to recall, and then to allow the idea in question to be brought up by means of these associations.

3. Memorizing: Efficiency in the formation of associations

The main question which we have to face with regard to memorizing, is concerned with the most effective way in which associations may be built up, so that they can be recalled at some time in the future in an efficient manner.

Association may be arbitrary or logical. We can best introduce our discussion of the laws of efficient memorizing by distinguishing between two kinds of association. On the one hand, we may form an association between ideas in a purely arbitrary manner. In this case we do not recognize

any similarity or other rational connection between the ideas. Take the case of the telephone number which is associated with a person's name. There is no rational connection between the number and the name of the person who possesses it. They are associated merely because they have been frequently named, or heard, or thought of together. On the other hand, there are other ideas which seem to belong together, and which we speak of as logically related. When ideas are related in this manner we call the association a logical association, and the formation of such an association we speak of as logical memorizing. Thus when we memorize a piece of prose or poetry, the words follow one another, not in a purely arbitrary way, but because they express a series of thoughts. The successive words are suggested, not merely because they have previously existed together in our minds, but because they also express thoughts which follow one another naturally. We may distinguish, then, between logical memory and rote memory, by saying that, in logical memory, the associations which are formed fit into a group of associations which have been previously formed, and which constitute a system of thought. This fact gives them a meaning. In the case of rote memory, on the other hand, we have to form the associations between the things which are presented, without making a connection between them and a larger system of thought.[1] As an example, we may compare the process of memorizing such a sentence as, "The country went democratic by a small majority," with the process of memorizing the following series of nonsense syllables: neb, siv, dof, rin, sog, tuz, muv, gaj, fid, kel, bip, cag. In the one case we may memorize the sentence which expresses a coherent meaning by a single

[1] Logical memory is the association of words, facts, events, etc., which are so connected in meaning that the relation is recognized. Rote memory is association which has little or no meaning.

repetition, whereas it would probably require ten or more repetitions to memorize the nonsense syllables.

The same fact or event may often be associated in either manner. This distinction between logical and rote memory is not, however, a perfectly sharp one. There are intermediate cases between memorizing in which the associations are without meaning, and those in which the meaning is at the maximum. Furthermore, the same piece may be memorized by one person by means of logical memorizing, whereas to another person the association may be of the purely arbitrary kind. A date may be memorized without connecting the date with others, or without connecting the events which correspond to the date with other previous and succeeding events. In this case one merely makes a mechanical and arbitrary association and fixes it by means of many repetitions. The person who has some knowledge of history, however, may be assisted in making the association by recalling the period in which the event took place, and the general location of the period in time, — such as the century or part of the century in which it occurred. By this means he will have narrowed down the possible choice of dates to a fairly small number. If he is thus able to determine in what century the event occurred he has determined the first two figures of the date, assuming that the number is in the thousands; and if further he can locate it in its decade, he has determined the first three figures. It is then very much easier to supply the last one or two missing figures than it would be to supply all four of them.

The more the associations possess a logical character the fewer repetitions will be required to fix them. This illustration suggests the difference between the mode of learning when the associations are of the logical sort and when they are of the arbitrary sort. The more the memorizing has the character of rote learning, the more it must be accomplished

through mere repetition. The more logical it becomes, on the other hand, or the more associations the learner is able to make with the things which are to be memorized, the less the necessity for a large number of repetitions. At one extreme of logical memory is the case in which the material is learned by a single perusal. At the other extreme is the memorizing of nonsense syllables, or of a series of meaningless numbers, in which it is necessary to make a large number of repetitions. Here again the distinction is not a sharp one, because even in logical memorizing it may be necessary to repeat the material several times before it is sufficiently well learned to be reproduced. There are usually certain elements of the material that are arbitrary. The ideas of a poem or a prose selection might be expressed in several ways, or the various ideas which are expressed might come in one order or another, so that the memorization is to some extent arbitrary. In general, however, the more one can find meaning in what is being memorized, the fewer will be the repetitions necessary.

4. Rules for memorizing

First rule: Get the meaning clearly in mind. The distinction just mentioned leads to the first practical rule which may be laid down for memorizing: namely, so far as possible, work out clearly the meaning of the material which is to be memorized. Facility in memorizing depends in large measure upon the extent to which the learner is able to find systems of associations into which the ideas that are being memorized can be fitted. The illustration of various methods of learning dates is an example of this principle. Another example may be taken from memorizing the words of a connected piece. In such memorizing, one may go about the work in a very mechanical way. He may repeat the words over and over again and try merely to learn them so that

they can be repeated without much thought of the meaning which they express. This is the method which the child is likely to pursue unless he is directed to a better one. It is the purely verbal method of memorizing. A better method is to first read over the piece and get as clear an idea as possible of the leading and subordinate thoughts which together make up the meaning of the piece. One should then give attention to the logical order of the thoughts or the order of development of the main thought. After this has been done, the main parts of what is to be memorized will fall into their proper order without much difficulty, and the remainder consists chiefly in associating the particular words and sentences with one another. We shall discuss the methods more in detail when we come to the question of the relative value of the whole and part method of memorizing.

Second rule: Make as many repetitions as are necessary to fix the arbitrary associations. However much attention we may give to the thought of the piece which is to be memorized, there will still remain the necessity for some mechanical association or of some arbitrary or rote memory, as has already been said. For most persons this will necessitate, even in the case of logical memory, more than one reading or recital before the piece is learned. With some persons, it is true, who have a very high degree of skill in verbal memory, one reading of a fairly long poem will suffice to fix it in mind; but this simply means that such persons have a high degree of ability in rote memory, and not that rote memory is not present in such cases. A second rule may accordingly be stated thus: When memorizing is intended to be verbally accurate a number of repetitions are necessary. Even in logical memory repetition is usually an essential feature of the learning process; and of course the more the memorizing is of the arbitrary sort, the more this is true. The next question is concerned with the best way of making the

repetitions, in order that we may remember with the least amount of effort and the greatest amount of permanence and accuracy.

Third rule: Continue the repetitions beyond the threshold. One principle which may be mentioned first regarding repetitions in memorizing, is that they ought to be carried beyond the point at which the learner can repeat the piece immediately. Put in technical terms the rule is: For permanent memorizing, carry the learning beyond the threshold of immediate reproduction. The reason for this principle is that a person's memory does not permanently remain at the degree of perfection which is reached at the time of memorizing. What has been memorized always fades from the mind to a greater or less extent. The amount which is forgotten in each unit of time is greater soon after the memorizing has been completed than it is later. Figures 17 and 18 may be taken to represent what may be called the curve of forgetting, or the amount which remains in the memory at various intervals after memorizing has been completed. The extent to which learning should be carried beyond the threshold will depend on the purpose with which the memorizing is carried on. If the material is intended to be ready to hand at a distant future time it must be carried very far beyond the threshold of immediate reproduction.

Fourth rule: Distribute the repetitions. To carry the repetition sufficiently beyond the threshold so that the piece memorized may be instantly recalled at a distant future time, is a wasteful process if the learning is done all at one period. It is necessary in this case to make a very large number of repetitions, in addition to those which are necessary to enable one to repeat immediately what is being learned. A much more economical method is to continue the repetitions a sufficient number of times to make it possible to reproduce the piece immediately, if it is short, or if it is long, to carry

the learning only part way to the threshold of immediate reproduction, and then to go over the material again at a later period. This distribution of the repetitions over several periods of study may be carried, under proper circumstances, to a considerable length. The number of periods which it

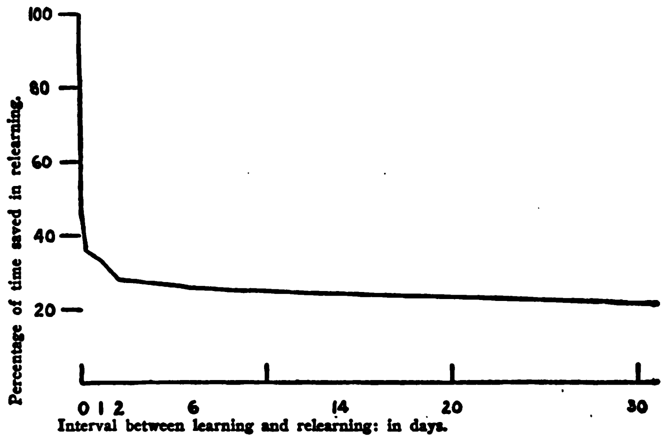

FIG. 17. THE CURVE OF FORGETTING FOR NONSENSE SERIES LEARNED TO THE POINT OF ONE SUCCESSFUL REPRODUCTION, IN THE CASE OF EBBINGHAUS

(From E. L. Thorndike's *Educational Psychology*, vol. II, by permission of Teachers College, Columbia University.)

is desirable to use in memorizing any particular subject matter will depend upon the length of the piece and its difficulty, and upon the age or ability of the learner, and so on. The principle is sufficiently general, however, to warrant the following rule: To secure economy in the number of repetitions distribute them over several periods.

The degree of distribution varies with circumstances. How far we may profitably go in distributing the periods of study has not been determined in detail for all circumstances.

As has been said, the length of the periods of study which are most economical will depend on the length and difficulty of the material, and on the age and ability of the learner. For young children, the periods of study can be reduced advantageously to rather short ones, perhaps ten minutes. The

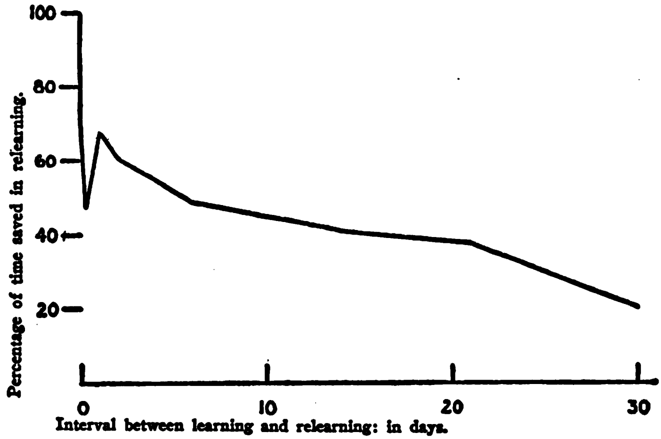

FIG. 18. THE CURVE OF FORGETTING FOR NONSENSE SERIES LEARNED TO THE POINT OF TWO SUCCESSFUL REPETITIONS AS REPORTED BY RADOSSAWLJEWITSCH

(From E. L. Thorndike's *Educational Psychology*, vol. II, by permission of Teachers College, Columbia University.)

more the memorizing is of the character of rote learning the more advantageous it is to shorten the periods. When memorizing is logical in nature, on the other hand, a longer period may be advantageously used, due to the fact that with a longer period one is better able to get the course of the thought as a whole.

Too concentrated learning hinders progress through fatigue. This principle, that it is more economical to distribute learning throughout several periods rather than to concen-

trate it all into one period, is found to hold in other forms of learning besides memorizing. At least a partial explanation of this principle may be found in the fact that the longer one works the slower the progress becomes, if the work is all carried on in a single period. The point beyond which one ceases to make progress, of course, varies with individuals and with the kind of work, but with small children, this point comes rather soon. Therefore if the learning is concentrated the latter part of the period does not produce as much effect as does the earlier part.

Old associations are most permanent. The distribution of repetitions also results in the more permanent retention of what has been learned as a consequence of another principle, which may be stated thus: The longer an association has been kept above the threshold, — that is, freshly in mind, — the more permanent it becomes. A clear illustration of the difference between associations which have been kept fresh for some time and those which have been recently formed is furnished by a comparison of those students who keep their work up during a whole course of study with those who cram up for examination at the end. Those who keep their work up retain a good share of what they have learned after the course is over, while the crammers speedily forget their recently acquired knowledge. There may be some subjects on which we wish to acquire information for a particular occasion and then forget it, but this cannot be true of the more fundamental part of the work of the school. We shall see in a later part of the chapter that this principle partly explains the apparently better memory of children than of adults.

The intention to remember facilitates learning. The most efficient learning of which a person is capable is not guaranteed merely by the proper arrangement of the outward conditions of the work. Very much will depend on the

attitude of mind of the learner. If he goes over the material in a lackadaisical way, without paying very strict attention to what he is doing, and without the intention to remember what he is reading over or listening to, the repetitions will have very little effect. Even those who have experimented with memorizing, and who are to be considered as possessing an average degree of ability, have sometimes found that they did not remember series of words which they had repeated to their subjects a number of times, although the repetitions were sufficiently numerous to enable three or four persons in succession to memorize them. The difference in the result must be ascribed to a difference in purpose.

Fifth rule: Attempt to recall during learning. In order that this intention to remember may be prominent in the mind of the learner it is well to form the habit of stopping occasionally to see how much can be remembered of what is being studied. This practice will keep the learner in the proper attitude of mind, so that the repetitions which he makes will result in his being able to reproduce as soon as is possible. We may assume, perhaps, that the continued repetitions will make impressions of some sort on one's nervous system, but they may not take the sort of impression which can be turned to account in intentionally recalling the facts which are gone over. In order that the facts may be at the call of the learner, or in order that he may be able to reproduce them when he desires to do so, it is necessary that he make the repetitions in the first place with this purpose in mind; and, as has been suggested, the effort to recall during intervals of the learning will serve to maintain this attitude. We may accordingly establish this rule: Pause occasionally during the learning to attempt to recall what has been gone over.

Sixth rule: Make the first perusal with especial care. Of

the various repetitions which are made in learning, the first one is by all odds the most important. It is often very difficult to overcome a wrong impression which was gained in the first perusal. This is a matter of common observation as well as a fact which has been established by experiment. If the first repetition is made in a careless and superficial way, the others have very much less effect than if the first impression is made carefully. It is particularly desirable that the first repetition be made with the attempt to get the meaning so far as possible of what is about to be memorized, and to get the meaning correctly. The fact seems to be that those parts of any piece which a person neglects on his first reading, he tends to overlook in his successive readings, so that if one has studied a book carelessly and without forming correct notions of its meaning, it becomes more difficult for him in the future to apprehend its meaning accurately than it would be to take up in the same way an entirely new book. There are two plausible explanations of this fact of observation. In the first place a superficial reading gives many false interpretations of the meaning of the piece, and these false interpretations are likely to persist in spite of later more careful readings. This is in accordance with the principle of apperception, that an interpretation of any matter of experience is greatly influenced by our preconceptions. In the second place, the first reading takes the keen edge off our curiosity and it is more difficult afterwards to give close attention than when the interest was at its height. From these facts we deduce the rule: Give close attention and try to gain an accurate interpretation of the thought at the first perusal.

Seventh rule: Avoid false associations. Partly as bearing on the value and importance of first impressions, and partly as it is related to succeeding impressions, another principle is of considerable importance. This principle is

that false associations should be avoided so far as possible. The bearing of this principle is frequently seen in common experience. If we are attempting to recollect a person's name and a wrong name comes to our mind, we find it much more difficult than it would otherwise have been to recall the correct one. When we attempt to recall the name our mind is diverted to this wrong association. Other examples are found in learning to speak, which is one form of memorizing. If a person has formed the habit of spelling a word wrong he not only continues to spell the word wrong unless his attention is particularly directed to his error, but he fails to notice the difference between his own spelling and the correct spelling when he meets it in his reading. The reason for the lack of economy from forming wrong associations, then, is that it is necessary in such cases, not merely to form the correct association, but in addition to this, to break the wrong ones which have been formed. It frequently requires greater effort to break up a wrong association than it would have cost to form the correct one in the first place. Whence the rule: Carefully avoid false associations.

Eighth rule: Learn under some pressure. Although learning should be careful and fairly deliberate, particularly at the first, it must not be carried on too slowly. We must distinguish between undue haste which is accompanied by carelessness and which is likely to produce a large number of errors, and such a degree of effort or pressure as will make the whole process more effective. Some degree of pressure, some urgency or effort in learning, will make the learning more rapid and the results more permanent. Repetitions which are made when the mind is not fully alive, or when it is not accompanied by any feeling of urgency or of desire to learn, are apt not to be economical. There is, of course, a rightly applied effort, and a wrongly applied effort. When the effort is merely the attempt to spur one's self on, it

may not succeed. It may rather defeat its own end. Just what the conditions are which make effort fruitful or unfruitful we shall discuss more particularly in the chapter on mental economy, but we may say for the present: Learn under some pressure.

5. *The whole and part methods*

In memorizing extended pieces, two general methods have been distinguished. We may either repeat the whole piece and attempt to learn it as a whole gradually, or we may repeat small parts at a time, and try to learn it thoroughly as we go along. The two methods are called the whole and the part methods.

The whole method is, in general, the better. Although the part method is the one most commonly used, experiments seem to indicate that the whole method enables one to memorize with the least waste of time and energy. There are of course qualifications in regard to the kind of piece, and so on, but it is usually better to read over the whole piece and then continue to study it as a whole, rather than to study it piecemeal.

The whole method avoids false associations and makes associations with the thought easier. The reason for the superiority of the whole method in general seems to be that when one uses this method there are no associations formed which are unnecessary and which have to be overcome. In learning by the part method, the last words of a part are associated with the beginning of the same part instead of the following one. As a result, when one comes to the end of the stanza it often calls up the beginning of the same stanza and one is unable to proceed. This is in fact an experience which is common. In the second place, the whole method has an advantage, not only because the associations are formed between each part and the parts preceding and fol-

lowing, but because associations are also formed between each part and the thought of the whole piece. Because of this fact learning by the whole method has more the character of logical memorizing than has learning by the part method, and in accordance with this fact it has been found to be more permanent in effect.

Extra time must be given to difficult parts. In the application of the whole method there are certain difficulties which must be met. It is found that before a piece is learned completely, certain parts prove to be more difficult than other parts. The easier parts may be learned long before the harder parts. It is therefore a waste of time to go over the parts already learned in order to learn the others. We must accordingly modify the method by permitting a more prolonged study of the more difficult parts as soon as it has been determined what these parts are.

In the application of the whole method the length of the piece and its general difficulty, as well as the age and memory capacity of the learner, must be considered. The great difficulty with the whole method is that the learner feels it to be a formidable task to learn in this way. He does not appear to make progress in the earlier repetitions. He therefore tends to lose confidence in his ability to memorize, and, as we shall see in the later chapter on learning, confidence is one of the most important conditions for economical learning. If the piece is long, then, it should be broken up into sections which are long enough to represent a fairly large division of thought, but which are not long enough to prevent the learner from seeing any evidence of his progress. In the case of young children, and of those who learn with difficulty, the divisions should be smaller than in the case of adults or of rapid learners. Difficult material should be broken up into smaller divisions than easy material. But keeping these qualifications in mind it is safe to say that

most persons can with advantage learn by larger divisions than they would choose spontaneously.

The part method may be better for some individuals. There may also be another qualification with reference to the superiority of the whole method, based upon the individuality of the learner. Experiments with large classes of adults indicate that without special practice in the whole method there are some who seem to do better with the part method, although the average of the whole class is in favor of the whole method. If this should prove to be true after the whole method has been practiced longer, and if it should prove to be true with children, it would be necessary to make allowances for this fact in directing the learning of the individual child. It is possible that there are differences in the way in which different persons memorize to the greatest advantage. This principle of method, like all others, must be applied with due regard for the capacity and the individual type of ability of each person.

Summary on the whole and part methods. We may apply the principles concerning the whole and part methods in a series of rules: —

1. First get a clear idea of the thought of the whole piece and then divide it into fairly large divisions, making the divisions correspond to the natural divisions of the thought. If the piece is short it will not need to be divided at all.

2. The length of a piece which may be learned as a whole, or the length of divisions, depends on the difficulty of the piece, the age of the learner and the individuality of the learner. There is not yet sufficient evidence upon which to base a more specific rule regarding length.

3. When the easier parts of a division have been learned, extra repetitions should be devoted to the more difficult parts.

4. Especial attention should be given to the connections between divisions.

6. *Individual and age differences*

Whatever may be the case in regard to individual differences with reference to the preferred method of learning, it is certainly true that different persons vary in their memory ability. The variation is wide and concerns both the speed with which different persons can memorize for immediate reproduction, and the percentage of the material which can be reproduced at a later time. The difference in the rate at which different persons can memorize the same material is very large. Out of a class of persons who do not differ so widely in general ability as do the pupils of most large classes, some can memorize the same material three times as rapidly as can others. Furthermore, if the learners are required to memorize again what they memorized previously, it will take some a correspondingly larger amount of time in the relearning. We may illustrate these differences by two cases from a class of nineteen adults. One of the class memorized a poem at the rate of 28.5 lines per hour and relearned it at a later time at the rate of 101 lines per hour. Another individual memorized the same poem at the rate of 79.5 lines per hour and relearned at the rate of 336 lines per hour.

Rapidity of learning and permanence may or may not correspond. It is not true that the rapid learner always remembers the most of what he learns, or vice versa. Some memorize quickly and retain a large percentage, — perhaps eighty or more per cent of what they memorize. Others take a comparatively long time to learn, and retain a small percentage, say thirty. On the other hand, some slow learners retain a large amount, and some fast learners retain a small amount; and in addition there is an intermediate group composed of those who learn with moderate rapidity and retain a moderate amount.

Rapid learning is as likely to go with unusual permanence

as the reverse. This runs counter to the traditional view to which we have been accustomed, which is that slow learners remember accurately and for a long time, while fast learners are superficial. If there is any general relationship, it is rather that the faster learner retains better; but there seems to be little connection between speed and retention, if one compares the ability of different persons. These facts must be considered in regulating the different tasks which we set to different children, and the demands which we make of them. We should have some fairly definite notion of the amount which a particular child can learn and should avoid making an undue demand on the slow child on the one hand, or giving insufficient tasks to the fast learner on the other.

An individual's memory can be improved. While it is true that persons differ in their ability to memorize, we must not conclude that a particular person's ability may not be modified by training. Training, it is true, will not make all persons alike; but a large amount of training may increase the ability of one who is particularly deficient in this kind of mental work. We know little as yet about the amount of training which would be necessary to raise the ability of the poor memorizer up to the level of the person of average ability in memorizing. We cannot assume that the same amount of drill will produce the same degree of ability in different children. What we do know is that at least a majority of persons are capable of improvement in their memorizing ability. The facts which will enable us to suit memory drill to the need and capacity of each individual will have to be determined more completely by future experimentation,

7. *Change with age in association and memory*

The child's spontaneous associations are restricted. One of the tests of the Binet-Simon series throws light on the range and spontaneity of the child's associations which is

rather surprising. In this test the child is asked to give all the words he can think of, and he is given a time limit of three minutes. From our observation of the child's constant activity, and the freedom of his imaginative life, we might expect that he would excel in such a performance as this. But the fact is quite the reverse. After a short spurt at the beginning the child's responses begin to run down. He gets fresh starts by naming the objects he sees about him, but at each lower age the responses are slower than at the ages above. The same poverty in free association is met with in a test in which the child is given a word and is asked to give the first word he thinks of. Frequently the word that the child gives has no relation to the one he hears, or the relation is one of sound rather than of meaning.

The child's experiences are limited and unorganized. The poorness of the child's free association illustrates the remark which is often made concerning freedom in general — that it is not absence of restriction, but the possession of trained ability to act. The child does possess a certain spontaneity, but the exercise of this spontaneity depends, for one thing, upon those experiences with things and persons which furnish him with ideas. He can never create an idea out of whole cloth. The child who has the most experiences, other things being equal, will have the greatest freedom of thought and action because he has the materials out of which thought and action can be built. But it is possible for a child to be overwhelmed with mere experiences. The manner in which the more mature person succeeds in the free association test is instructive. The more successful he is, the more likely he is to give words which exhibit *trains* of associations. His ideas are *grouped* or *organized*, so that, for example, one animal will suggest other animals, one food other foods or one building other buildings. Thus when he gets an idea he has really tapped the course of a whole series of ideas.

The process of organization of experiences is as important in education as is the processes of getting experiences.

The child is also deficient in the control of associations. The deficiency of the child in following trains of associations is one illustration of the poorness of his control over the connections of his ideas. His lack of control is also brought out by another kind of examination. We may ask the child to give, not any word which comes into his mind, but one of some specified sort — as the opposite of a given word, one that is related by cause and effect, or one which designates a part of which the given word designates the whole, or the reverse. For instance, the child may be asked to tell the opposite of *high*, or to name an effect of the cause designated by *cold*, or to name a part when *house* is given to designate the whole. The child can meet these tests, but he can succeed in more and more difficult examples as he grows older. This progress is undoubtedly due in part to the child's increasing experience, which makes him better acquainted with the individual ideas. It may safely be assumed, however, that part of the growth consists in the better control or management of ideas so that their relations are more clearly recognized. The control of associated ideas is a very important phase of reasoning, and its development affects growth in reasoning, as we shall see in the consideration of that subject.

Memory improves with age up to maturity. The development of the ability to make permanent associations, which we call memorizing, also grows with age. We have been accustomed to think that the younger child can memorize better than the adult, and that there is a particular stage of development when he can memorize better than he can before or after. Experimentation shows that for certain kinds of memorizing at least, both of these beliefs are erroneous. When we test the ability of the child to learn

nonsense syllables, or to learn voluntarily a piece which has been set for him, we find that his ability increases with age rapidly up to about fourteen or fifteen and more slowly from then on, but that the adult is superior to the child of any age.

The child's apparent preference for memorizing may not be real. There may be several reasons for the discrepancy between the results of experiments and the common belief of teachers and others who have to do with children. One reason probably is that children do not avoid memorizing as adults do. This seems to be the method which the child takes to spontaneously when he is required to learn. Probably this is not because he likes memorizing much better than does the older person so much as it is to the fact that he has not yet learned to use other methods of study. Children may perhaps often have a dislike for the mechanical, rote sort of learning, but this dislike may not be brought to our notice because they take it as a matter of course that they are required to do their learning in this way. The adult, when he is left to his own devices, turns away from this rather tedious method, and takes up the more convenient and comfortable method of learning by grasping the ideas of what is being studied.

The child makes many repetitions. Another reason that the child seems to learn with more facility than the adult is that in many cases he employs a great number of repetitions in learning a story or a poem. We do not realize the number of repetitions which he experiences in listening to the recital of the piece. We therefore underestimate the length of time or the number of repetitions which it has required for him to learn it. If we make allowance for these facts it is entirely credible that the child cannot memorize a set piece with the same facility that a youth or an adult can memorize such a piece. The sum of the evidence goes to show that, in voluntary memorizing, or in deliberate memo-

rizing, one becomes more efficient up to maturity; and experiments, such as those of Meumann, have shown that there is still a possibility for indefinite improvement.

The child's spontaneously received impressions appear to be very lasting. There seem to be facts of observation which indicate that some kinds of impressions which a child receives are retained by him with as great or greater exactness than the impressions which are made upon the mind of the adult. Such are those impressions which a child receives through the spontaneous attention he gives to the events about him. The boy who sees a fire engine upon the street is giving his whole attention to this object, and he is tremendously interested in it. The impressions which the objects make upon his mind are very strong on account of this attention and interest. We may assume that a child ordinarily pays attention to those things in which he is intensely interested, and that accordingly the casual impressions which he receives may be stronger than most of those made upon the mind of the older person.

The memory of adults for childhood events is due to keeping impressions fresh for a long time. Aside from the fact that such spontaneous impressions may be very lasting, the evidence for the superior retentiveness of the memory of a child is probably false. We often hear used as an example of the greatest retentiveness of the child's memory the fact that poems learned in early childhood remain clearly in our minds, when others which have been learned since that time have faded out of our minds. This does not illustrate a superior memory upon the part of the child, but rather another law which has been already mentioned, namely, that the older an impression becomes, the more likely it is to remain a permanent possession. If something has been learned a long time ago, and if we have repeated it sufficiently so that we retain our memory of it, it makes a very

lasting impression in our minds. A more recent acquisition, on the other hand, tends to fade out more quickly. This explains our memory of those pieces which have been learned in childhood. Many of them have faded from mind, but those which have been repeated occasionally so as to be kept fresh become thereby firmly fixed, and they probably will be retained in memory through life. By exercising care to revive impressions occasionally by repetition, some time after the original learning, the adult can attain somewhat the same permanence which is possessed by such of the child's memories as persist.

QUESTIONS AND TOPICS FOR DISCUSSION

1. Would you ascribe the horse's turning in at his gate to memory? Why?
2. Is memorizing wholly like memory in the full sense of memory? How does it compare with habit? Does it in any sense go beyond habit?
3. Give four illustrations of association other than memory.
4. Give an instance of a logical association and pick it to pieces to show why it is called logical.
5. Give an illustration of your own of the way by which meaning may be found in an association.
6. Mention several kinds of material which ought to be learned beyond the threshold.
7. Is care in the first perusal inconsistent with making a quick, preliminary survey to get the main points?
8. Give illustrations from your own experience of the effect of learning under pressure.
9. Why, do you think, is the whole method of memorizing particularly valuable for permanence?

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CHAPTER XI

PROBLEM-SOLVING OR THINKING

The puzzle illustrates the problem-solving type of learning. We have thus far been describing the kind of learning which consists in the formations of associations between movements and stimuli, which we have called sensori-motor learning, the acquirement of the ability to recognize and interpret impressions, which has been called perceptual learning, and the formation of associations between ideas. There is another type of learning which is radically different from these. We may illustrate this type of learning by a simple experiment. Figure 19 is one that was used by Lindley in an experiment which will be referred to shortly. This figure is an example of the unicursal puzzle. The problem is to trace the figure without omitting any part, without lifting the pencil and without retracing any lines. Let the reader attempt the puzzle and then come back to the discussion and interpretation.

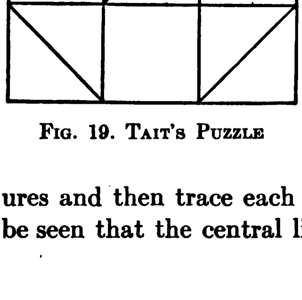


FIG. 19. TAIT'S PUZZLE

In the solution analysis plays an important part. This puzzle may be solved in a variety of ways. The most efficient method in the long run is to analyze the figure into a number of simpler figures and then trace each of these figures by itself. It will be seen that the central line is a separate element, and in

order to trace the figure one must begin at one end of this line. After this is done the other figures may be traced one

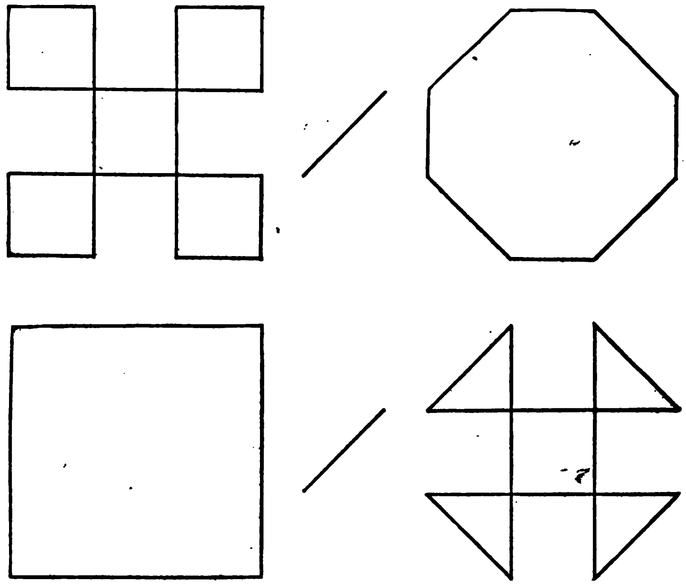


Fig. 20. Illustrations of Forms of Analysis

at a time. Figure 20 illustrates two ways in which this analysis may be made.

The distinguishing feature is the clear recognition of a problem and of its solution. This form of learning is different from those which have been described, in the fact that it consists in the solution of a problem. We start out with a question in mind, and we examine the problem in various ways until finally we are able, as we say, "to see through" the problem. When we have finished, we understand the conditions and the solution. We have not merely acquired

a habit of response which we know will succeed because it has succeeded in the past, but we understand why this particular mode of response succeeds.

Problem-solving is a typically human procedure. The contrast between this form of learning and the simpler forms may be illustrated also by the experiment which is sometimes used in animal learning, in which the animal learns to get out of a cage which is fastened by a latch, bolt or other fastening. The animal in this case acquires the appropriate response because he finds through repeated random trials that this response releases the door. The human being, on the other hand, would be likely to attack such a problem by studying the relationship of the bolt and the latch so that he could solve it at the first attempt, and so that after he had solved it he would understand why the movement which he made released the latch and opened the door.

Other examples. There are many instances in our everyday life which furnish opportunities for thinking or problem-solving. It is true we can and do meet these situations frequently in an habitual or instinctive manner. We do not analyze the situation, discover its various elements and their bearing upon the solution, and reason toward a conclusion. But the opportunity is there even if we do not take it. In the arrangement of one's life in such a way as to meet the conditions of health in the best possible manner there is a capital opportunity to exercise thought. It is said, probably with truth, that nearly all persons live much below their possible efficiency because they do not properly obey the laws of health. In order to live up to the highest possible efficiency of which one is capable it is necessary to know the general principles which have been discovered by science. This, however, is not sufficient. It requires considerable study to know just how the general principles of right living are to be applied in one's own individual case. Each person

has his peculiar capacities and peculiar demands upon his strength. The task before him is to discover how he can best utilize his strength in order to meet his duties. To do this adequately he needs not to follow custom and habit, but to experiment and discover the best possible arrangement of his own life. Vocations also present this problem. The choice of one's life work demands that one should weigh the opportunities presented by the various callings, and match the opportunities with his abilities and interests and the possible training which he can get for himself. The proper exercise of one's civic and political duties furnishes another excellent opportunity. It requires a strenuous exercise of one's mind to think through the issues which are presented in a political campaign and to attempt to weigh the character and the abilities of the various candidates. If it is possible, then, to train the child to think, it is of the greatest importance that we should do so.

Problem-solving depends upon the grasp of relationships which contribute to a solution. Put in general terms, the difference between this higher form of learning, which we may call problem-solving, and the lower forms, which are largely the formation of associations, consists in the fact that, in the problem-solving type of learning, one grasps or apprehends certain relationships in the situation. The learner is able to see that one fact bears upon another in such a way that he can solve the problem by proceeding in an orderly manner. When one understands the fallacy or the correctness of an argument, it is not because he has found by experience that one sort of argument succeeds and the other does not; but it is because he sees that, in the fallacious argument, the statements do not hold together, whereas, in the correct argument, one statement depends upon another. We may accordingly define problem-solving or thinking as *setting up a conscious goal, the attainment of which presents*

difficulties, and the discovery and recognition of that relationship between the elements of the problem which will lead to its solution.

Chess illustrates the problem-solving attitude. Another illustration of the problem-solving type of learning may be found in learning to play chess, which was studied by Cleveland. Here again we have a case in which the aim is to understand the relationship of the various elements in such a way that one may discover a response which meets certain definite conditions. When the chess player has become an expert, he is able to see a large number of these relationships simultaneously and to foresee the result of a long series of moves. The beginner can only see a few relationships and these only one at a time. The expert at chess acquires what is called a sense of position. Sense of position means the ability to grasp the position of the various pieces in such a way that the possibilities of future moves can be apprehended.

Intelligent problem-solving may be combined with random trial in various proportions. Lindley has shown that in solving the type of puzzle which is illustrated above, a person very frequently is able to break up the problem into its parts, and see how these parts are related to one another, with sufficient clearness so that he can give the correct drawing at the first attempt. In other cases a person may proceed in a blind fashion and use a more primitive method of finding the solution for this kind of problem. We must not suppose that because the problem is present, a person necessarily uses the higher type of learning, or of understanding, in solving it. An extensive study of the problem-solving type of learning has been made by Ruger, who used mechanical puzzles. Ruger found that various methods may be used in the solution of such problems. An intelligent or unintelligent mode of procedure may be used. One may pro-

ceed systematically to consider the various modes of attacking the problem, or he may go about it in a hit-or-miss fashion. Finally, after the problem has once been solved, one may not understand how it was done and so may find it necessary to blunder about again as he did the first time. In other cases, even a hit-or-miss solution may result in an understanding of the problem and of its conditions in such a way that it can be immediately solved thereafter.

All forms of learning involve some kind of analysis. While there are differences among the various forms of learning which have been described, there are also some common features. The most common of these are two. In all these forms of learning there is, in the first place, an analysis or breaking up of some phase of the situation or of the response. In the case of sensori-motor learning, the analysis may consist in the selection of one movement out of a whole group of movements, or it may consist in the selection of a certain stimulus to which a particular response is to be made. In perceptual learning, as illustrated in drawing, one must break up the figure, or the object which is to be recognized, into parts, before a complete recognition of the organized whole is possible. In the case of the problem-solving type of learning, this analysis or breaking up of a problem into its elements is equally evident from the illustrations which have been given.

All forms of learning also involve the association of elements. The other phase of learning consists in putting together those elements which have been analyzed, and is again illustrated in both sensori-motor and the higher types of learning. In any complex form of movement it is necessary to combine movements into a coördination. Thus in the case of handwriting, after we have separated the movements of the thumb and the first two fingers from those of the last two fingers, it becomes necessary to acquire the ability

to use these fingers simultaneously or in an appropriate order. We have also to make the finger movements in the proper relationship of time or of strength to the movements of the arm. In perceptual learning we have to organize the elements in order to build up an object which shall have definite meaning. In learning to draw a figure, the lines are combined into a figure which had a clearly recognized form. In learning to read, we put the letters together in the recognition of a word or a combination of words. In the problem-solving type of learning we reach the solution by recognizing the fact that the different elements of the problem are related to one another in a certain definite way so as to contribute to the solution. In learning to open a lock we see that the springs and the levers have such a relation that by pressing one lever the others will be released. The unique feature of problem-solving, then, is not the fact that it requires that we break up a situation into its elements and associate the elements. It is rather in the manner in which this breaking up and associating is done. The analysis is made more or less intelligently, with more or less definite purpose and method, which grows out of an understanding of the nature of the problem; and the association is not only made, but is also recognized. There is insight into the reason that the particular combination of elements leads to the solution.

1. *Reasoning* [1]

Reasoning is a clear recognition of the steps in solving a problem. When this higher type of learning, which is called problem-solving, reaches the stage in which we definitely and consciously pass through a number of steps in order to reach a solution, and clearly recognize that these

[1] Reasoning is sometimes taken to include merely deductive thinking, but the term is here taken to mean both inductive and deductive thinking.

steps are dependent upon one another because they lead in the direction of the solution, we call the mental process reasoning. We may describe in a little further detail what the steps of reasoning are, and may illustrate the different kinds of reasoning.

An illustration of scientific thinking in an every-day situation. A clear description of the steps through which one passes in problem-solving is given by Dewey in *How We Think*, page 70. An example which he uses may be quoted to illustrate these steps: —

In washing tumblers in hot soap-suds and placing them mouth downward on a plate, bubbles appeared on the outside of the mouth of the tumblers and then went inside. Why? The presence of bubbles suggests air, which I note must come from the inside of the tumbler. I see that the soapy water on the plate prevents the escape of the air except as it is caught in the bubbles. But why should air leave the tumbler? There was no substance entering to force it out. It must have expanded. It expands by increase of heat or by decrease of pressure, or by both. Could the air have become heated after the tumbler was taken from the hot suds? Clearly not the air that was already entangled in the water. If heated air was the cause, cold air must have entered in transferring the tumblers from the suds to the plate. I test to see if this supposition is true by taking several more tumblers out. Some I shake so as to make sure of entrapping cold air in them. Some I take out holding mouth downward in order to prevent cold air from entering. Bubbles appear on the outside of every one of the former and on none of the latter. I must be right in my inference. Air from the outside must have been expanded by the heat of the tumbler, which explains the appearance of the bubbles on the outside.

But why do they then go inside? Cold contracts. The tumbler cooled and also the air in it. Tension was removed and hence bubbles appeared inside. To be sure of this, I test by placing a cup of ice on the tumbler while the bubbles are still forming outside. They soon reverse.

Upon examination, each instance[1] reveals more or less clearly, five logically distinct steps; (1) a felt difficulty; (2) its location and

[1] Other illustrations beside the one here reproduced were also given.

definition; (3) suggestion of possible solutions; (4) development by reasoning of the bearings of the suggestions; (5) further observation and experiment leading to its acceptance or rejection; that is the conclusion of belief or disbelief.

In induction an explanation is sought for observed facts. It will be seen that in the full solution of a problem, as illustrated in this case, there are two forms of procedure which are constantly illustrated in the study of natural science. We may distinguish between two kinds of problems. In attempting the solution of the first type of problem, we ask ourselves the question, "What principle may be found which satisfactorily explains these facts which have been observed?" In the illustration before us, the facts which were observed were the alternate expansion and contraction of the soap bubbles. In order to explain these facts, it was suggested that the principle of expansion of air through heat and its contraction through cold might explain the fact. In order to determine certainly that this principle did account for it, further observation and experiment had to be made, but the first procedure was to cast about for some general principle which would explain the fact. This was the form of procedure which in natural science is called induction. It may be illustrated in the case of the problem as to the conditions which are necessary to the growth of plants. One may observe a variety of plants, or the same plants under a variety of conditions, and notice that certain amounts of water will produce luxuriant growth and that smaller amounts will produce less luxuriant growth, and that still smaller amounts will produce death. The generalization on these observed facts is induction, and, as a result of this procedure, one develops a general principle as to the relationship of water supply to plant growth.

In deduction the consequences of a general principle are predicted. After the generalization had been reached in the

study of the soap bubbles, it was not regarded as proved but rather as a tentative conclusion. We call such a tentative generalization an hypothesis. The application of an hypothesis through deduction is the next step.

A good illustration of the application of a general principle through deduction is the discovery of the planet Neptune. After the general law of gravitation had been discovered and applied to the movements of the planets it appeared that the planet Uranus did not follow the path which was to be expected on the basis of this law. Through elaborate calculations it was determined that if the law was correct the movement of the planet Uranus could be explained by the presence of another planet of a particular size and in a particular position. An astronomer then turned his telescope toward this region of the heavens and discovered the planet Neptune. This is a beautiful example of the application of the general principle of gravitation and of the confirmation of that principle by virtue of the fact that the prediction which was based upon its application turned out to be correct. Deduction, then, may be said in general to be the answer to the question, "If this general principle is true, what will be the result in a particular case?"

Deduction is used to test an induction. In the experiment on soap bubbles, the application of the principle was not made in order to test the reliability of the principle of the expansion of air by heat, but its purpose was to test the reliability of the inference that this principle is the explanation of the observed facts. Supposing that the alternate contraction and expansion was due to heating and cooling, if the cold air were taken into the glass when it was set down the expansion would occur; whereas if the glass were lifted in such a way that cold air was not caught in it, there would be only contraction. This application of the principle was found to work and the principle was confirmed. In this

case we see another application of the question, "If this principle is true, what will be the result?" for the purpose of confirming the correctness of an hypothesis.

Induction is emphasized in research, deduction in applied science. Induction, or the discovery of general principles, is the general method of research. It is the method pursued by the scientist who wishes to explain facts which have not already been explained by the discovery of new principles, or by the application to them of principles which have been previously discovered. Deduction, on the other hand, is the procedure of applied sciences in which new applications are made of familiar principles. Engineering is an illustration of this process. Engineering takes the laws which have been discovered in regard to the amount of strain which various metals will stand, and the amount of strain to which materials are subjected in different forms of structure, and applies these principles to the building of a bridge or the construction of a building. Deduction may be used in the verification of principles, in the sense that applications are made for the purpose of confirming or rejecting hypotheses; and induction may be made in applied sciences to determine what the general principles are which would apply in a particular case; but, in general, the one method is used mainly in research and the other chiefly in applied science.

Problem-solving requires independent discovery. There is a marked contrast between true problem-solving and the process which we sometimes describe as thinking or reasoning. It is not thinking for the student to simply follow the beaten path which another has made before him. True thinking always involves the element of uncertainty as to the path which is to be followed and the independent discovery of this path. The contrast may be illustrated in the study of geometry. In the old style method in which the demonstration was clearly set forth in a series of steps and the pupil

was required to follow and learn this demonstration there was very little true problem-solving involved. The true method of solving such a problem as this is to discover what facts are known which will contribute toward the proof of the proposition which is to be demonstrated, and to learn how these facts can be set in such an order that they will lead toward the solution. When the student sets out independently to discover such a proof, he begins with the aim or the goal, and casts about in his mind for suggestions of known facts which will help him toward the solution. When he merely follows the proof in the text he begins with facts which have already been selected for him, and passes from one to another without seeing how they contribute toward the solution until the solution has finally been reached. The element of the discovery and selection of the appropriate facts, which is present in all true problem-solving, is here lacking.

Independent discovery may be present in greater or less degree. The principle that the student should be thrown on his own resources is sometimes stated in too sweeping fashion. It is of course out of the question that the pupil should discover without any assistance those scientific laws which have required centuries of research by the ablest minds of the world to discover. The teacher prepares the way of the pupil to the discovery of the facts which he investigates. The very formulation of the problem itself in precise terms is a help toward its solution. The discovery of a problem may be said to be as important or more important than the solution of the problem itself, and frequently the clear statement of a problem is sufficient to make its solution easy. The teacher may carry the assistance a step farther by suggesting possible facts which might contribute toward the solution. The part which would be left to the pupil in this case would be the selection of those facts which are

appropriate and the rejection of the others. The teacher might even go another step farther without completely doing the work for the pupil. The facts which contribute toward the solution might be stated, but they might not be arranged in such a way as to show their bearings upon the problem. The pupil might then be asked to show how the facts bear on the problem and to draw the conclusion from them.

Thinking is related to a knowledge of logic much as speaking and writing are related to a knowledge of grammar. The principles of correct thinking of a deductive sort have been worked out and systematized in formal logic. A great many rules have been thus laid down determining what one can do and cannot do in valid reasoning from general principles to conclusions. In order that the relations of the statements which are laid down in an argument may be clearly brought out they are arranged in a particular order. The most general statement, upon which the conclusion is founded, is called the major premise and is placed first. The particular fact which is assumed by the argument to be true, and is taken as the further basis of the conclusion, is placed next; and the conclusion follows last. Certain rules can then be applied to this series of principles or statements, called a syllogism, to test its correctness. Take for example, the following syllogism:—

Major premise: Oranges will not grow without an amount of moisture equivalent to twenty inches of rainfall.

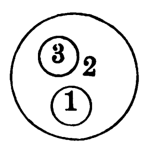
Minor premise: There is rainfall amounting to twenty inches in the State of Illinois.

Conclusion: Therefore, oranges will grow in Illinois.

One does not have to have been a student of logic in order to realize that this argument is not correct. The province of logic is to determine just where the error gets in. This may be done by recasting the three statements. It may then be shown why they do not hold together. Thus: —

All places in which oranges will grow are places in which there is an amount of moisture equivalent to twenty inches of rainfall.
Illinois is a place in which there is an amount of moisture equivalent to twenty inches of rainfall.
Therefore, Illinois is a place in which oranges will grow

This makes each statement an assertion of a relation between two terms. In all three statements, however, there are only three terms; namely, (1) places in which oranges will grow; (2) places in which there is an amount of moisture equivalent to twenty inches of rainfall; and (3) Illinois. The first and third terms are brought into relation in the conclusion by first bringing each of them into relation to the second in the premises. The second is therefore called the middle term. Why then is the argument not valid? The fallacy may be made clear in a diagram. Let each term be represented by a circle. The following situation is possible. The middle term (2) does not necessarily bring the other two (1 and 3) into relation. In order to have done so it should have included all the cases to which it may refer in one or the other premise. Thus if the major premise had been —



All places in which there is an amount of moisture equivalent to 20 inches of rainfall are places in which oranges will grow, —

the argument would have held. The technical statement of the rule is that the middle term must be distributed in at least one of the premises.

A knowledge of logic does not teach one how to think but is of assistance in detecting incorrect reasoning. Besides a knowledge of the laws of correct reasoning other characteristics are necessary to make one an efficient reasoner. In the first place a knowledge of logic is largely a negative affair. It enables one to check up his own errors

or the errors which are made by other people, but does not point positively to the path which one should pursue. In order to reason one must have a supply of ideas about the subject with which he is dealing, and a knowledge of logic never gives him these ideas. In the second place, just as one may know a rule of grammar and still violate it, so one may know the principles of correct reasoning and still commit a fallacy. The fact that one knows the law does not guarantee that one will always be alert to his own infractions of the law. Therefore a large amount of practice in thinking and in checking up one's own arguments and the arguments of others is of more value than a knowledge of the formal principles, though these are worth while in making clear to one's self the reason for the mistakes which are made.

A knowledge of the scientific method is of assistance in inductive thinking. The procedure of the trained thinker is contrasted with that of the untrained or careless thinker in several ways. The first and perhaps the most important is the avoidance of the practice of jumping to conclusions. The trained thinker always suspends his judgment until the evidence is sufficient to make it reasonable to draw his conclusions. The suspension of judgment is always a difficult thing for the untrained or uncritical thinker. He tends to accept the first explanation which offers itself. This, of course, is always more of a temptation in a field in which one's knowledge is not extensive, but it is also a more general characteristic of the thinking of some individuals than of others. It is always a rather uncomfortable thing to hold one's judgment in abeyance and to give up the pleasure of making up one's mind. The danger in too hastily jumping to a conclusion is that we thereby become unable to give proper attention to opposing considerations. Our minds are closed to other evidence.

The second characteristic of the scientific method is systematic procedure. An extreme example of this is the method by which Edison is said to have discovered the material from which the carbon filament of incandescent lights could be made. It is said that he systematically tried out thousands of substances before the bamboo filament which was finally adopted was discovered. One needs to ask himself where the evidence is which bears upon the problem before him, and then systematically to search for the evidence until a sufficient amount is discovered to make the conclusion valid. The two general methods of search for evidence in a systematic way are the statistical and the experimental method. In the statistical method the investigator counts up the facts which are already in existence and which might throw light on his problem, and in the experimental method he creates the facts by an artificial means.

A third requirement of correct scientific thinking is that one should be free from prejudice in the matter which he is investigating. This is perhaps the most difficult attitude to maintain. One may be prejudiced because of his previous scientific beliefs or because the question which he is investigating seems to him to touch upon moral or religious matters and is therefore associated with strong emotions. The mere habit of believing a certain principle makes it difficult to believe the opposite one. It is important that one should form the practice of examining his beliefs in order to see whether he holds them because of the evidence which exists to support them or only because he has grown accustomed to them. All of these characteristics of the scientific method may be cultivated. It is easiest to apply them in a field in which one has worked, and there are persons who are scientific in their own field of work but are prejudiced and hasty in their conclusions in other fields. It is possible, however, to get such a clear grasp of these principles, and to get such

a habit of putting them into practice, that they may become more or less a part of all one's thinking.

Efficient thinking demands the possession of adequate information. We saw in the analysis of the process of thinking that the movement of thought from the problem to its conclusion depended upon the suggestion of ideas which represent possible solutions. This fertility of association may depend in part upon the thinker's native constitution of mind. One person may have few ideas and another many because of their inborn nature. The fertility of ideas depends, however, in part upon another condition which is susceptible of improvement. One has many ideas on subjects on which he has large quantities of information and few ideas on subjects concerning which his information is limited. It is customary to draw a contrast between ability in thinking and mere ability to amass information. It is true that we sometimes meet persons who have a retentive memory and can give many facts, but who have not put these facts together so as to draw conclusions. They lack the mental control and the recognition of relationship which is necessary for thinking. On the other hand, a person is always limited if he does not possess adequate information. A first-class reasoner is never lacking in the ability to assemble facts to use as the basis of his conclusions. The possession of a store of facts is always of especial value in the construction of an argument which shall be convincing to other persons. The lawyer is incompetent as a reasoner about health and disease, not because he is a poor thinker in general, but because he does not possess the necessary knowledge in this field. In the same way the physician is not a reliable reasoner with reference to matters of law. The criticism which has often been made upon the mere collection of facts and the memorizing of information by the child is likely to carry us too far to the other extreme and to lead us to a

contempt for facts which will greatly hamper the process of thinking.

Familiarity with good models of reasoning is of value. If we had to choose between familiarity with examples of reasoning from masters in the various fields of science and a study of the laws of logic, the choice would lie with familiarity with good models. As in sensori-motor learning so also in problem-solving one learns much by imitation. The modern school and college fail to give the student sufficient contact with the writings of the first-rate thinkers of the world. A student may go through high school and college and never read any scientific works except the textbooks. The text is necessary to summarize the present knowledge in any field of knowledge, but it would also be highly valuable for the student to come in direct contact with some of the original investigations which have served as landmarks in the development of science. To bring the student in contact with such masters as Adam Smith in Economics, Darwin in Biology, or William James in Psychology is to do him a service which cannot be supplied by secondhand reworking of these men's ideas.

2. Individual and age differences

The child is said to be fit only for mechanical forms of learning. A stock generalization regarding the child and his development is that before adolescence the child's actions are controlled by habit, memory, and authority, but that he does not learn to reason until the period of youth. This principle is often applied to the education of the child during the intermediate period of his elementary school life. It is urged that at this time the child is capable chiefly of drill and of memorization, — that is, of the more mechanical sorts of learning. It is said that this is the period when he should be storing his mind with a wide range of facts, even

although he may not understand them at the time; and that he should at this period be acquiring a great variety of habits without himself recognizing the value or the significance of these habits. This recognition he will gain with the development of his reason at the time of youth.

Tests show that the child can reason. It is difficult to understand how a person who observes a child in his spontaneous activities can hold such a belief regarding his ability to reason. Bonser's experiments, which were made to test the child's ability in this direction, indicate comparatively little difference between the child of eight and the youth. The test was given to all of the children from the fourth to the sixth grades. In the lower grades there were some children as young as eight years of age and in the upper grades there were some who were sixteen. When these children were grouped according to age a good many of those in the younger group gave as good responses to the tests as did the better ones of the older groups. There was, to be sure, some error in this comparison, due to the fact that only the brighter of the younger children would be included by such a method of selection, whereas of those above twelve years of age only the slower or the duller ones would be included. But even with this qualification the facts are remarkable.

An illustration of a child's reasoning. In further support of the belief that the child can reason, the following illustration may be offered from the life of a child of five years of age. This boy was taking his afternoon rest in company with his father, but was restless and wished to get up and play. The following colloquy took place: —

Boy: "I am not tired."
Father: "Yes, you are. I can tell because you wiggle so much."
Boy: "Then you are not tired."
Father: "Why?"
Boy: "Because you do not wiggle."

There is, of course, a fallacy in the boy's argument, but if we excluded all arguments which contain fallacies, we could materially reduce the evidence of reasoning on the part of adults.

Reasoning is limited by experience. The child's reasoning is naturally limited by the experience which he has had and the material which is within his understanding. In much the same way the reasoning of the primitive or the uneducated person is limited. The European peasant who believes in the efficacy of a silly and superstitious mode of treatment for disease is not thereby exhibiting a lack of ability to reason, but rather the lack of opportunity to develop his capacity for reasoning. The child is continually drawing conclusions within his own sphere. The task of the educator is to determine what that sphere is and how rapidly it can be widened at different ages, and what type of reasoning is suited to the different stages of development.

The child has characteristic deficiencies in reasoning. This does not mean that there are no differences in the ability of the child to reason at different ages. The child before adolescence certainly does reason, but he suffers from certain defects or deficiencies which very commonly make his reasoning unsound. These defects again are not different in kind from those which affect the reasoning of older persons, but they are present in a somewhat higher degree, due to the peculiar conditions of the child's stage of development. Some of these conditions may be briefly mentioned.

Narrow range of information is one cause of limitation in reasoning. In the first place, as has already been said, it is clear that the correctness of a person's reasoning will depend in a large measure upon the amount of experience which he has had, and the amount of information he possesses on the subject on which he reasons. If this is true in the case of adults, and if the expert in a certain field is

able to reason better than the person who lacks information about it, it is clear that the child suffers from a disability in this matter which affects not only certain subjects but subjects in general. Because of his narrower range of information, it is evident that he does not have the material with which to reason with the same effectiveness that the older person does.

The child is deficient in critical judgment. Beyond this difference in his experience, the child seems to lack somewhat the ability to suspend judgment and to bring to bear upon any course of argument a variety of considerations. We express this by saying that he lacks critical judgment. We mean by critical judgment the disposition to examine any conclusion with reference to all the information which may bear upon it. How far this deficiency in critical judgment may be a general feature of the child's mind, and how far it is merely the result of his deficient experience we do not know. A person is more critical in those fields with which he is familiar than in others, and the educated person is in general more critical in his judgment than is the ignorant person. We may ascribe at least part of the child's deficiency in critical judgment, then, to his lack of experience. Another way of putting this same principle is to say that the child is more suggestible than the adult. He is more apt to follow the course of thinking which is laid down by another person without judging for himself whether it is correct or not.

The child is less capable of sustained, patient thought than the adult. Some limitation in thinking ability is also due undoubtedly to the child's narrower mental scope, and deficient ability in sustaining his attention to a given subject for a considerable length of time. In order to reason properly it is necessary that we keep in mind the various possible considerations which may affect the problem. If we

lose sight of some of these we may reach a conclusion which is unbalanced, in which certain of the facts are not taken into account. The child is notoriously apt to follow out one issue, or one side of a question without taking into account the

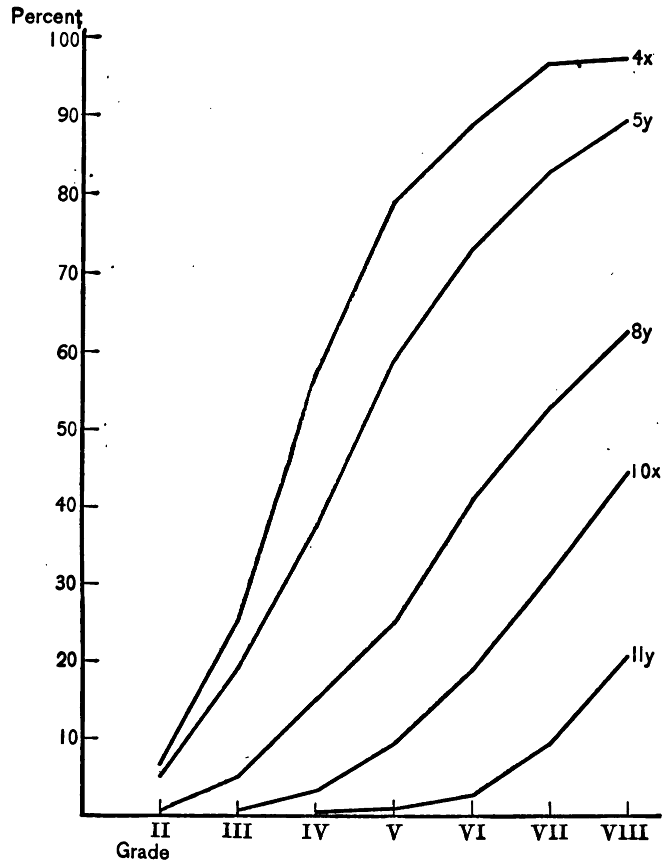


FIG. 21. AGE PROGRESS CURVES IN PROBLEMS OF THE SAME KIND BUT DIFFERENT DIFFICULTY

(Completion Sentences from Trabue.)

other. Furthermore, he soon tires of pursuing any particular course of thought. This, as in the other forms of disability, is a matter of degree. They do not mean that the child lacks certain powers which the adult has, but rather that certain propensities are not so highly developed in him as they are in the adult.

The child's intellectual development in general is gradual. The child's development in the ability to meet particular intellectual problems may be somewhat sudden, but the ability to do particular tasks is to be distinguished from ability in a general type of process. Whether we believe that the child's ability to think depends on his individual experience or upon the development of his nervous system and the inner factors of mental maturity, the observation of the child and the more scientific tests which have been made combine to indicate that his development is gradual. There is no sudden evolution in his ability to think. We frequently meet with a fairly rapid development in the ability to handle certain problems, but if we examine the ability of a child in an earlier stage, we will see that he was capable of handling a problem of the same general sort, provided it is an easier example of it. If again we observe him in a still later stage of his development, we see that he has progressed so that he is now able to handle a still more difficult problem of the same general type. To adequately measure the child's growth, then, it is necessary that we test him with a series of problems of advancing difficulty. There are critical periods with reference to any particular task or problem, and such a task or problem is an adequate test only for such a critical period. In an earlier period the child's almost complete inability to do the task is likely to lead to the false conclusion that he has no ability whatever of the type required, and his solution of the problem in a later age may not be a measure of his full ability to meet more difficult ones.

Graded tests furnish good illustrations of the child's intellectual growth. A study of the scores made by children of different ages upon a series of tests requiring the same type of ability but of increasing difficulty, furnishes good illustration of the principles brought out in the preceding paragraph. A good illustration of such a scale is the completion-test scales organized by Trabue. The scores of children from the second to the eighth grade in several successive steps of the scale are taken as the basis of Figure 21. The chart was constructed in this way: Each line represents the scores of the children for the various grades in one particular sentence. The height of the curve for a particular grade represents the total score made by the children of that grade. The sentences are designated by the numbers used in the original monograph. These sentences are as follows: —

4x. Time .... often more valuable .... money.
5y. The .... rises ...... the morning and .... at night.
8y. It is a .... task to be kind to every beggar .... for money.
10x. It is very .... to become .... acquainted .... persons who ...... timid.
11y. When one feels drowsy and ...., it .... happens that he is ...... to fix his attention very successfully ...... anything.

Suppose now we had only the scores for sentence 4x as a basis for judging the child's development in this type of intellectual capacity. We should say that the function developed very rapidly from the second grade to the fifth, and more slowly to the seventh grade, and that there it reached its maximum. If on the other hand we had the score of sentence 11y only we should say that this intellectual function developed hardly at all until the seventh grade, and then rather rapidly to the eighth, the course of development indicating the probability that it continued beyond this point. On the

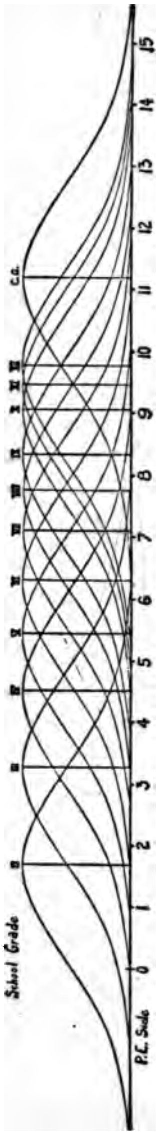


FIG. 22. RELATIONS OF GRADE DISTRIBUTIONS TO EACH OTHER

(From M. R. Trabue's *Completion-Test Language Scales*, by permission of Teachers College, Columbia University.)

basis of the scores of all the sentences, however, the only correct interpretation is that the child progresses steadily in his ability to do harder and harder tasks of the same sort, but that in one particular degree of difficulty there is a stage of development in which there is rather rapid progress preceded by a stage of low ability and followed by a stage of almost complete mastery.

Differences between individuals are large in comparison with the amount of progress with age. The advance in thinking with age in a problem of particular difficulty is complicated by the differences between individuals of the same age. The advance would be more rapid if it were not obscured by the factor of differences within each age. At any particular age or grade there are a number of children whose ability is less than the majority and another group whose ability is greater. The presence of these better and poorer pupils makes the advance in score gradual. A direct representation of the spread of the ability of different individuals of the same grade may be taken from the same monograph by Trabue. Figure 22 is a somewhat hypothetical drawing based upon the degree of scattering of the

scores of the children in each of the grades, and shows what we may expect in general the degree of distribution to be. Each bell-shaped curve represents the scores of the children in a particular grade, and the figures on the base line represent the scores. Thus in the fourth grade the scores of the different individual children extend from 0 to 9. The score marked C.G. represents college graduates. The scattering of the individuals of a particular group is so startlingly large that the only two groups which are entirely separated are those of the second grade and the college graduates. Between every other two groups there is some overlapping. There are some individuals in the second grade who get as good scores as some in the last year in the high school, and there are some in the third grade who do as well as some college graduates.

The differences in one particular test, especially when it is given only once, are much larger than would be the differences in a group of tests or in a single test given several times. There are certain accidental factors which place an individual's score high or low when the score is based only on a single determination. Even with these qualifications, however, the differences in ability among individuals of any particular age or among adults are tremendous in the field of thinking or of the higher intellectual processes, as in the field of sensori-motor ability, perception, or of memory. It is not surprising that the school finds great difficulty in classifying the pupils so that those of something like similar ability shall be together. The use of tests, both those of a general character and of tests of ability in the particular school subjects, has proven to be of help in the classification of children and is probably destined to be of still greater help in the future.

QUESTIONS AND TOPICS FOR DISCUSSION

1. Are the other forms of learning which have been described carried on without purpose or aim? If they also have purpose or aim, is it like that of problem-solving? If not, what is the difference?
2. Discuss with further illustrations the question whether animals solve problems.
3. What part of the definition of problem-solving, as it is given in this chapter, sets it off most clearly from other kinds of learning?
4. Find some illustration of problem-solving from your experience and analyze it into the five steps given by Dewey.
5. Tell which of the following cases of reasoning are inductive and which deductive, and give your reasons.
   a. The inference from mental and physical tests of children afflicted with malaria and hook worms that these diseases retard the child's physical and mental development.
   b. Using the facts and laws of fatigue and learning to infer what the best time schedule for third-grade pupils is.
   c. Drawing conclusions from the results of an appropriate experiment regarding the relative advantages of the part and whole methods of memorizing.
   d. Drawing up a plan for teaching spelling, using the results of experimental studies of the value of the various methods.
6. How do the deductive inferences indicated in the preceding question serve to check up the validity of inductions.
7. Mention two methods of teaching science, one of which emphasizes independent discovery and the other not.
8. How else is an argument to be criticized beside testing it for formal correctness — that is, for correctness in the relation between the premises and the conclusion? What kind of examination would such additional criticism require?
9. Show that the practice of patiently searching for evidence for beliefs includes the chief elements of the scientific method.
10. Give any evidence you can that the child reasons from his early years.
11. Give illustrations of the sorts of defects in reasoning to which the child is especially liable.

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CHAPTER XII

GENERAL PRINCIPLES REGARDING THE CHILD'S MENTAL DEVELOPMENT

The contrast between different ages

IN the discussion of the separate forms of mental development in the child we have met with illustrations of the difference between the child at different ages. In this chapter we shall attempt to bring together the various facts which appear from a study of the development of the instincts and capacities in order to draw some general conclusions as to the laws of mental growth. In the history of thought regarding the child and his development we have swung from one extreme to another. The earlier students and writers upon the child emphasized the necessity of understanding and taking account of the differences which exist between the child and the adult. Rousseau, for example, criticized sharply the practice, which was characteristic of his time, of treating the child as a small adult. Rousseau dwelt upon the fact that the child is not merely weaker than the adult, but that his capacities and instincts are different in kind from those of the adult. Writers on child-study from the time of Rousseau to the present have emphasized differences in the constitution of the child's physical nature and in his interests and capacities. It is a well-known fact that the bones of the child contain a less percentage of lime than do the bones of the adult. After the physical analogy it is sometimes said also that the child lacks such a capacity as moral discrimination and that this develops at about the time of adolescence. We shall discuss this point more at length presently.

An example: The child's docility has been exaggerated. Although it was formerly necessary to emphasize the distinction between the child and the adult, the pendulum has swung so far to the opposite extreme that it becomes necessary now to emphasize those points in which the child is like the adult. This is not merely necessary for the sake of gaining a correct scientific notion of the child, but also as a corrective for some of our practices toward him. For example, we ordinarily assume, and our science affirms, that the child is more docile than is the older person. The child is dependent for the ideas which govern and control his conduct upon the direction of older persons, and he is willing to submit his conduct to such control. Although it is true that the child will cheerfully accept more direction and control than the adult, yet this point can very easily be overemphasized. The child likes to control his own conduct, and very commonly he resents interference with it. He takes a pride in his ability to do things and very often would rather find out how to solve a problem than to be shown by another.

It is not fruitful to inquire, When do certain capacities appear? We must not, of course, overlook the differences which actually exist at different ages, but we must avoid an erroneous interpretation of these differences. Because a child does not possess the ability to perform some task at one age and acquires that ability later may not mean that he has acquired any fundamentally new mental capacity. The first uncritical study of the differences between children of different ages is too apt to lead to this form of interpretation. The questions which such studies are sometimes made to answer are put in some such form as this, When does a certain power of capacity develop in the child? The result is a catalogue of the ages at which memory, imagination, reasoning, and so on, develop.

We should rather ask, What form do the capacities take at a certain age? A more critical study of the facts which have been discovered through studies of the child leads to another view of his development. This development is rather to be viewed as a gradual unfolding of his powers than as the acquisition of new powers. This unfolding, in which the same fundamental capacities appear in doing more and more complex things, was illustrated in the development of play and of reasoning. The question in the mind of the investigator or of the observer of the child should be rather, What forms do the fundamental capacities take at different times? than, When do certain capacities develop?

Changes in social attitude with age are exaggerated. An illustration of the exaggeration of the differences between the younger and the older child may be taken from his social attitude. A common statement is that before adolescence the child is egoistic or selfish, whereas at adolescence the child becomes altruistic. This contrast is not true on either side. The child is not entirely egoistic, even when we interpret the statement as meaning that he is merely oblivious to the interests and to the welfare of others. It is sometimes said that the child is not selfish, because he does not feel that the interests of others make any call or demand upon him; but that his attitude can be characterized as one of selfishness, because he is completely absorbed in his own interests.

The child has social impulses. This characterization leaves out of account the fact that the child possesses, in addition to the instincts which lead to self-gratification, those instincts which identify him and his interests with those of others. It was seen in a previous chapter that the child possesses impulses of sympathy and of affection. It is true that where there is a conflict between these generous impulses and the more selfish ones, the latter commonly seem

to be the stronger, but to ignore entirely the existence of the social impulses is to misrepresent the child's mental attitude.

The youth is not wholly unselfish. The other side of the picture is equally false when we take it to mean that the youth is wholly or predominantly altruistic. It could be shown that even in those acts which we think of as altruistic or as expressions of self-sacrifice the person is actuated by a sense of the close relationship between himself and those persons who are benefited by his action; that is, his actions are commonly for the sake of a group in which he feels himself to be closely identified rather than for the sake of others who have no relation to himself. It is rather, then, in the development of a sense of group relations that the youth differs from the child, and even in this it is a matter of degree rather than of development of a new sense or capacity.

The contrast between the child and the older person is due partly to the child's impulsiveness. Another source of the difference between the child and the adult in this and in similar forms of response is that the child is more impulsive in his reactions, while the adult gives more deliberate consideration to the situation which confronts him, and to the various reactions which are open to him. We saw that the development of indignation results from the association of the instinct of anger with considerations of justice or of injustice. The child may often be observed to express radically opposite types of attitude toward the same person in successive moments. As an older brother of five said of his little sister of two years of age, "She first hits me and then loves me."

The child distinguishes between right and wrong. Another contrast which has been made between the child and the youth concerns the recognition and expression of moral ideas. A common mode of description is to say that the child is unmoral, — that is, that he lacks the moral sense,

or the ability to distinguish between actions which are right and those which are wrong. It is difficult to see how this opinion can be held. The child's distinction between right and wrong is imperfect, to be sure. It rests upon a more external form of judgment than does that of the older person. The child learns to recognize one act as being bad and others as being good chiefly by their consequences, and without much reference to the motive which is behind the act. Furthermore, he gains a keen sense of the rightness or wrongness of the acts of other people before he applies the same distinction to his own acts, but in this he differs from the older person only in the matter of degree. Illustrations of both these defects can be found in the lives of adults.

The child gains greater independence of moral judgment and greater moral insight with age. It is true that the child's notions of right and wrong are gained chiefly from the attitudes which he observes in those about him. It is true also that as he grows older he comes to a truer appreciation of the reason why certain actions are right and others are wrong. But this insight which he gains is never a complete one, as is shown by the fact that adults in different nations or in different levels of civilization have widely different notions as to what is right or wrong. The child shows his capacity for making a distinction both by his ability to recognize it when he sees it made by another and also by the code which children develop in their association with one another. The development in this case, then, is not to be thought of as the acquirement of a new capacity but rather as its development into a completer form.

2. Factors in the child's development: current theories

The child's development waits partly on brain growth. The foregoing conclusion should not be taken to mean that the child's development is wholly due to his increase in ex-

perience. We know that the child's brain is immature in comparison with that of the adult. Up to eight years of age the child's brain is increasing rapidly in weight, and beyond that time there is a large amount of development in the formation of associations between the neurones of the brain. This progress in association never ceases so long as the individual continues to learn. It is more rapid, however, during the period of immaturity than it is during the period of adulthood. How far the child's development must wait upon the growth of the brain cells and how far it is merely dependent upon the growth of experience is a difficult question to determine. We may describe the development of the typical child without settling this question. The question arises when we attempt to explain what causes this development and attempt to lay down the limits beyond which the child's development at a certain age cannot go.

Some emphasize the importance of brain growth as a factor. Here, as in many other cases, we may distinguish two radically opposing views. On the one hand, there are those who have interpreted the facts of brain growth to mean that the child goes through a series of definite and widely different stages of growth. It would hardly be an exaggeration to characterize this view as meaning that the child is a different creature at different ages. We shall see in a moment how this notion has been developed in the culture-epoch theory.

Cases of precocious development emphasize the importance of experience. On the other hand, many students of the child are coming to think that too hard and fast a line has been drawn between the possibilities of children at different ages. The popular magazines have contained many descriptions of experiments which parents have conducted in the endeavor to bring about a very much more precocious development of their children than is common. There are his-

torical instances of successful attempts to produce such development. One of the best known of such instances is the case of the scholar, John Stuart Mill. In Mill's autobiography is described the method which his father pursued in his education. It is recorded there that the boy began to read Greek at three years of age, and that he organized and wrote a book on political economy, using the ideas which were given to him orally by his father, at the age of twelve. There are other instances of the same sort on record. The interpretation of such cases is still too uncertain to be made with much confidence or precision, but they should at least raise the question whether we have not held too rigidly to the notion of sharply defined stages of development.

This notion of the child's development as proceeding by means of the sudden appearance of new powers has been termed the theory of nascent stages.[1] The theory of nascent stages means that at certain definite times in the child's life a particular capacity suddenly appears. In the literal meaning of the word, the capacity is born. For example, this theory assumes that the interest in a particular form of play or that the capacity for imagination or the capacity for reasoning develops at a very definite time. This theory is also taken to mean that if a certain capacity or interest is not fostered at the time that it appears, it will die out and the opportunity for its development will be lost. In the light of the above discussion the theory of nascent stages must be regarded as true only to a limited extent. The child does not develop any important new capacities after the first two or three years at least, and we know so little about the most favorable time for the development of any interest

[1] A nascent stage in the child's development is a stage at which a new ability or a new form of ability is supposed to develop (literally *to be born*). The theory of nascent stages is that the sudden appearance of new abilities is the common method by which the child develops.

or capacity that we cannot say with confidence that there is a certain time when it is necessary to strike the iron in order that it may not grow cold.

An explanation of the order of development is offered in the culture-epoch theory. The doctrine of nascent stages has been developed another step in order to explain why the various interests or capacities develop at definite times. This second theory is based upon the assumption that there is such a definite time and order of development. If such is the case, it undoubtedly raises the problem of explaining the reason for such definiteness and such order. The theory which has been worked out to meet this problem is that the order of development in the child repeats the order of development in animal evolution and in the history of the human race. This is called the "recapitulation" or the "culture-epoch" theory.

The field covered by the recapitulation theory. The recapitulation theory is not confined to the explanation of the mental development of the child. In fact it was first formulated to explain certain similarities which were found between the human embryo at certain stages and certain of the lower forms of animal life. For example, at a certain time the embryo has gill slits which suggest the fish stage of development. This correspondence in physical growth is one which is not by any means complete. Only suggestions exist here and there to indicate a relationship between the human individual and previous stages in animal evolution.

The field covered by the culture-epoch theory. As the recapitulation theory was developed from the observation of physical growth and is confined largely to correspondence between animal evolution and embryological development (development before birth), so the culture-epoch theory serves to explain chiefly mental development, and deals with an assumed correspondence between the growth of the

child from birth to maturity, and the advance in human nature and in civilization from the beginning of the human race until the present. This distinction between the two forms of theory is not always maintained, but is usually implied.

There are difficulties with the theory due to the imperfect knowledge of primitive man. Aside from the criticism of the culture-epoch theory on the ground that the child's capacities do not develop suddenly or at definite stages, it may be tested by examining the attempts which have been made to establish a correspondence in detail. These attempts have been in the main very vague and unsatisfactory. There is an element of uncertainty in them which is based upon the limitation of our knowledge as to the characteristics in the mental life of primitive man. Radical changes are taking place in the views which anthropologists hold of primitive mental life. The illustrations which have been used to support the culture-epoch theory are based chiefly upon the older and now outgrown views of the characteristics of primitive man. For example, Herbert Spencer held the theory that the savage is lacking in inhibition or the ability to check the expression of impulses. The child clearly has this characteristic, and this was used as one of the illustrations of a correspondence. Present-day anthropologists, on the other hand, hold that the primitive man is more controlled by inhibitions than is the civilized man. Examples of these inhibitions are found in the various sorts of taboo. Various tribes have taboos with reference to food. Under certain conditions food must not be eaten and the savage will undergo extreme privation rather than violate this taboo. This shows that the older view of Spencer was incorrect, and the parallelism with the child's development breaks down.

Efforts to specify parallel stages are not satisfactory. It would seem that if there is any clear parallelism, it could

be most easily displayed by considering merely the broad stages of development. There might very well be a difficulty in establishing details, but the general outlines ought to be clear. In order to determine whether such parallelism can be clearly established we may take a typical attempt to work it out. The development of the child is divided into three stages as shown in the following table: —

TABLE IV WHICH ATTEMPTS TO SHOW CORRESPONDENCE BETWEEN THE DEVELOPMENT OF THE CHILD AND THE RACE [1]

Stages of development in the race	*Stages of development in the child*	*Ages*
Mythical and heroic	Intuitive sense perception	Birth to 6
Transition	Imagination and memory	6 to 10
Freedom and self-government	Logical thinking	10 to maturity

The description of the stages in the child's development is faulty. In examining the value of this parallelism we may first ask ourselves regarding the correctness of the description of the child's development. On this point the discussion in the earlier part of the chapter throws light. Imagination and memory are in this table placed at the years from six to ten. It is obvious that neither of these begins at six or ends at ten. It is difficult to see that they are particularly more prominent at this period than they are at any other period in the child's life. Again we found that logical thinking does not begin at a definite period but is present in the earliest years.

The correspondence between the two series is not clear. An examination of the correspondence between the stages

[1] *Second Report of National Herbart Society* (New York, 1896), p. 73. From an article by Levi Seeley, "Culture Epochs." Seeley takes the table from the Herbartian, Rosencranz.

brings out equally glaring faults. It is difficult to see why the mythical and heroic period should be related to intuitive sense perception. It would seem rather to be related to imagination. The second period of racial development is called intermediate. This means nothing, and is therefore merely a confession of inability to characterize such a period. The third period of freedom or of self-government does not appear to be essentially related to logical thinking. An assertion of freedom is rather more a matter of vigorous activity than of thinking. One might proceed to discuss the question how far the periods of racial development themselves are in accord with the facts, but the difficulties of the whole parallelism have been sufficiently brought out.

The safest course is to determine how the child develops by studying the child directly. It is difficult to see why one should attempt to learn about a fact which is near at hand for observation by studying another fact which is remote from observation, particularly when the relationship between the two facts is open to question. A very much more reliable method of determining the child's mental development is to study the child directly rather than to attempt to trace it through a study of racial development. This is particularly evident from the fact that in order to establish a relationship between the child and the race it is necessary first to study the child.

How far is the rate of the child's development fixed? This question of stages of development brings up a further problem with regard to the rate of development of the child. The theory of nascent stages or the culture-epoch theory assumes that there is a fairly definite rate of progress to which most children at least must conform; or at any rate these theories assume that the development of a particular child must take place at a certain rate which has been determined by the character of his nervous system. The child is

thought of somewhat after the manner of a clock which has been wound up to go at a certain fixed rate of speed.

Rate of development may be measured. It is necessary to examine this question of rate of mental development, not on the basis of theories, but on the basis of a study of the actual facts. There are two measures of rate of development which are at hand and which have been widely applied. In the first place, we may take note of the rapidity with which the child progresses through the grades of the school. In addition to this, there has been a scientific attempt to measure the rate of development of the child by testing his individual mental capacities. This latter attempt is embodied in the Binet-Simon Scale of Intelligence. This scale consists in a group of tests for each age which are supposed to be passed by all children at that age. If a child is able to pass tests for ages superior to his own, he is regarded as advanced. If he cannot reach the tests of his own age, he is regarded as retarded.

Children differ greatly in rate of advancement. On the basis both of school progress and of measurement by the Binet Scale it is found that there is a wide variation in the rapidity of development of different children. This variation is in both directions from that of the typical child; and it is probable that about the same number of children develop more rapidly than the average as develop more slowly. The rough measure which we are able to get from the Binet tests indicates that perhaps fifty per cent of children are either advanced or retarded by an amount equal to a year's development. Many, of course, are advanced or retarded by a larger amount.

Rapid development corresponds in general with high ability. We have not yet sufficient information to enable us to say with certainty what the significance of this difference in rate of development is, but it seems probable that the

children who develop more rapidly are in general superior in ability to those who develop slowly. The Binet Scale in its application to the study of feeble-mindedness assumes that the degree of mental deficiency of the child corresponds to the number of years which he is behind the typical child in development. This should not be taken to mean that such a child is altogether like the child of the age at which he is placed by the test. There are undoubtedly differences between the subnormal or the mentally deficient child and the normal child besides this one of a difference in rate of development; but that there is considerable correspondence between rate of development and ability is probable.

This view is contrary to one which has been traditional among educators. It has been commonly thought that precocious development is a distinct disadvantage to the child. This view has rested mainly upon the theory that the advance in evolution has consisted in the lengthening of the period of infancy or of immaturity. The longer period of infancy in the higher stages of evolution makes possible a greater mental development. The infant or the immature individual has greater leisure to devote to those activities which stimulate his development, and has greater time in which such development may take place.

The importance of lengthened infancy for the race does not apply to individual comparisons. This theory may be accepted with reference to a comparison of different evolutionary stages without its being necessarily applied to a comparison of different individuals in the same evolutionary stage. Here again, as in the case of the culture-epoch theory, it is safer to examine the facts which are presented to us rather than to apply a more or less remote theory. One of the facts which has been established, in addition to those resulting from the application of the Binet tests, is that the physically superior child, — that is, the child who is heavier

or taller than the typical one, — is farther advanced in the school, on the average, than the physically inferior child. There is, of course, opportunity for a great deal of individual variation, but this is the general rule. This would seem to indicate that there is a correspondence between physical precocity and mental precocity. These children have not yet been followed to adulthood in order to determine how they compare with the slower developing children in the long run, but the conclusion is suggested by the fact that taller and heavier children are the ones who have their rapid growth earlier.

Cases of extreme precocity suggest the necessity of a modification of the traditional view. The extreme opposite of the common opinion with reference to precocity is represented in experiments already referred to, which have been tried by a few parents who have attempted to bring about a much more rapid development in their children than is usual. The best known case of such an experiment is that made by Professor Boris Sidis of Harvard. Sidis succeeded in so educating his son that he entered Harvard at the age of ten and at this age he was sufficiently advanced in his mathematical studies that he lectured on the fourth dimension to a body of expert mathematicians. Reference has already been made to the case of John Stuart Mill. Experiments of this kind have been watched with interest, but it will be necessary to follow such cases to maturity and to study them from the point of view not merely of proficiency in some special type of intellectual ability but also in their whole conduct of life before definite conclusions can be drawn from them. Furthermore, we must know whether or not there are cases in which such attempts do not succeed or produce undesirable results. It is natural that the successful attempts should be the ones which should be given publicity. It may be that there are failures of which we do not know.

3. Conclusion

The foregoing discussion has been largely critical of certain types of interpretation of the child's mental development. The view that the child develops in certain definite and clearly marked stages, that he acquires at certain turning points radically new capacities, and that this development can be explained by some such theory as the culture-epoch theory has been combated. It becomes necessary in conclusion, to attempt to say in what the child's development does consist and what are the conditions or the factors by which it is produced.

An important factor is the development of interests. One of the important aspects of the child's development is the difference in interest which appears at different ages. The child may have a capacity to perform certain tasks at a certain time, but he may not desire to do so. Those differences in interest which undoubtedly exist may be partly instinctive and partly the result of knowledge and experience. To take an illustration from the development of play, we found that the girl is much interested in dolls at about the age of seven or eight. This interest is not so keen a little later. The loss of interest in dolls might be explained partly by the waning of an instinctive tendency, and partly by such growth in mental development that the child substitutes for this interest an interest in something else. A thing may become uninteresting because it has lost its meaning to a person through his ability to appreciate some higher form of activity. In addition to an instinctive basis for the development of interest, it is undoubtedly to be explained partly as a result of one's growth in knowledge and experience. A person cannot long be interested in trying to perform an activity which is beyond his power, or in an object which he cannot understand. We find that in adult life our interest in

a field develops as our knowledge in that field enlarges. We find also another similarity to the development of the interests of the child, namely, that we are at first interested in the more superficial aspects of things, but that we become interested in their fundamental aspects as we become more acquainted with them. A person unacquainted with electricity is attracted by the glitter and movement of the machinery by which electricity is produced, whereas the expert in the field may think rather in terms of the energy which is being transformed as expressed in kilowatts or amperes. Thus our interest not merely becomes greater in those fields in which we are versed, but also changes in reference to the aspects of things in which we are interested.

Mental development is also undoubtedly partly to be explained by growth in the simpler, elementary capacities of the mind. The number of objects to which one can pay attention simultaneously places upon our thinking certain limitations. The child very likely has a somewhat narrower scope of attention than has the adult. Experiments which have been made in order to test this matter, however, indicate that the difference is slight. While the adult may grasp from six to eight objects which are presented to his sight, the child of eight years of age may grasp within one of as many objects.

Growth in scope of attention is partly due to familiarity with the material. Even this difference may possibly be due to a difference in familiarity with the procedure of testing. When we examine the scope of attention for more complex things, such as groups of dots instead of single dots, we find that there is a greater difference. This corresponds to the fact that we can hold in mind a larger number of things with which we are familiar than of those which are new to us. The adult has a larger scope of attention with reference to some things than with reference to others. One unfamiliar

with machinery can see only one thing at a time when observing a machine, whereas an expert can distribute his attention over the various parts of the machine. Thus, in order to discover a fault in the mechanism, the novice would have to examine it part by part while the expert could detect it in a general survey. We can comprehend the directions for a trip throughout a part of the city with which we are familiar very much better than when the region is unfamiliar to us.

A large factor is the accumulation of experience. Whereas, then, we may ascribe the development of the child partly to the growth in fundamental interests or capacities, we must account for a large part of his mental growth by the accumulation of experience. The child's mental development is extremely rapid, largely because he starts out with no experience whatever and has everything to learn in the world about him. The adult has acquired a familiarity with the ordinary facts of his surroundings and his development proceeds only in the direction of certain of the details.

Instincts are more important as factors in social development, and experience is more important in intellectual development. This emphasis on experience should not be taken to mean that the development of instincts has no effect upon the child's mental growth in general. We may make a distinction between the sphere of mental development which is more affected by the instincts and that which is more affected by experience. Those attitudes of the child which govern his social responses are probably due in larger measure to the appearance of instincts at certain stages in his life than is the development of the intellectual ability. The outstanding example of the influence of instincts upon social attitudes is, of course, the change or modification which takes place at adolescence. This is the most prominent example of the importance of instincts in governing stages of

development. So far as intellectual development is concerned, a much larger share must be ascribed to experience than has commonly been done.

Stages of development need to be carefully investigated. The emphasis which has been put in this chapter on the likeness between the child in different stages of development, and the argument that the stages of development are not so rigid as has been thought or so fixed by the inner laws of the child's growth, should not be taken to mean that it is a matter of indifference at what period a particular subject is taught. It is still necessary to examine carefully the natural stages of development, — and would be even if they depended only on the acquirement of experience. The ability to count to one hundred and to understand the higher numbers follows, and does not precede, the ability to count to ten and the familiarity with the smaller numbers. In order to understand the meaning of the moral questions which are met in the government of a nation or in the conduct of a corporation one must have had sufficient experience to know what kind of human relationships are represented in such institutions.

The aim of the whole book is to describe stages of development in learning. It appears then that there are two main principles which govern stages of development. The one, which in the past has been overemphasized, is the development of instincts. In this, mere inner growth has a large share. The chapters on the instincts have been concerned with the description of the main outlines of this phase of the child's mental development. The other is the intellectual development of the child as represented in various forms of learning. In this the general principles of learning are of greater weight, though the development of the instincts also has some effect on the process. The chapters upon the various forms of learning were concerned with showing the stages of development in learning. This development was

seen to be due in part to training in each specific form of learning, and in part to the child's general mental growth. This general mental growth in the forms of intellectual ability turned out to be very largely the composite result of the various particular forms of training — that is, of experience. The more detailed discussion of the relation of particular forms of training to general mental development belongs to the next chapter.

QUESTIONS AND TOPICS FOR DISCUSSION

1. Is the adult equally docile or equally independent under all circumstances? What are some of the conditions which engender docility?
2. What practical difference does it make whether we think of the child at a certain age as not having a particular capacity, such as reasoning or moral judgment — or whether we think of him as having the capacity in low degree or incomplete form?
3. Give illustrations of the fact that the older person's appearance of superior benevolence is sometimes due to his acquirement of control over the expression of his impulses.
4. Is any criticism to be made of the view that the adult is radically different from the child in his moral life in that his moral judgments are based upon his own independent observation and reflection?
5. If it were possible for the child to be born with the brain fully developed so far as inner growth is concerned, would he be mentally mature at birth? Explain your answer.
6. Would there be any similarity between the mental development of the child and the race apart from the inheritance by the child of a predisposition to a particular order of development? Explain.
7. Illustrate differences between children in rate of mental growth.

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CHAPTER XIII

TRANSFER OF TRAINING, OR GENERAL TRAINING

Can the child receive general training? The problem which is the subject of consideration in this chapter has already been incidentally referred to in previous chapters. It is, in general, the question of the effect of learning in certain specific fields upon the development of the child in general, or upon his ability to act more efficiently in other fields of work. We may put the question in this way: Does the development which the child gains through his education consist merely in gathering information and in acquiring skill in one particular subject or in one particular narrow field of activity, or does he gain abilities which will make him more efficient when he meets problems in other situations? To take a specific illustration which has already been used: Can the child acquire the scientific method in one study in such a way that he may apply this method of approach to problems of another sort?

Bain emphasizes the element of form in learning. The problem may be put by three quotations, two of which express the affirmative answer to this question, and the other the negative answer. The first of these quotations is from an article entitled *Education as a Science*, by the psychologist Alexander Bain.[1]

The element of Form, Method, Order, Organization, as contrasted with the subject-matter viewed without reference to form, has a value of its own; and any material that displays it to ad-

[1] Quoted by Heck, *Mental Discipline* (1st ed.), p. 18. The page reference given by Heck (*Mind*, 1878, pp. 139–41) is incorrect, but the author has not succeeded in finding the correct page reference.

vantage, and enables it to be acquired, is justified by that circumstance alone. The targets used in learning to shoot, the wooden soldiers which we aimed at in saber drill, although unreal, are effectual. It depends partly on the teacher and partly on the scholar whether the element shall stand forth and extend itself, or whether the subjects shall yield only their quantum of matter or information.

Thorndike emphasizes specialized habits. The second quotation is from an earlier writing of Thorndike, in which he expresses considerable skepticism as to the amount and value of transfer of training. This quotation is taken from *Principles of Teaching*.

The mind is by no means a collection of a few general faculties, observation, attention, memory, reasoning and the like, but is the sum total of countless particular capacities, each of which is to some extent independent of the others, — each of which must to some extent be educated by itself. The task of teaching is not to develop a reasoning faculty, but many special powers of thought about different kinds of facts. It is not to alter our general powers of attention, but to build up many particular powers of attending to different kinds of facts. . . .

Training the mind means the development of thousands of particular independent capacities, the formation of countless particular habits, for the working of any mental capacity depends upon the concrete data with which it works. Improvement of any mental function of activity will improve others only in so far as they possess elements common to it also. The amount of identical elements in different mental functions and the amount of general influence from special training are much less than common opinion supposes. The most common and surest source of general improvement of a capacity is to train it in many particular connections.[1]

Judd emphasizes generalization. As contrasted with the emphasis placed by Thorndike and others on habit, Judd

[1] Professor Thorndike has taken a much more hospitable attitude toward transfer of training in his later *Educational Psychology*, vol. II. But the seeds sown in the earlier writings of this and other authors are still bearing a harvest of opinion among practical school men.

calls attention to the possibility of transfer in the field of thinking: —

The important psychological fact involved in the above statements is that the extent to which the student generalizes his training is itself a measure of the degree to which he has secured from any course the highest form of training. One of the major characteristics of human intelligence is to be defined by calling attention, as was pointed out in the chapter on science, to the fact that a human being is able to generalize his experience. James has discussed this matter by using the example of the animal trained to open a particular latch. The animal becomes acquainted with the necessary movements to open one door, but he never has the ability to generalize this experience. He cannot see that the same method of opening doors is applicable to many other latches. The result is that the animal goes through life with one particular narrow mode of behavior, and exhibits his lack of intelligence by his inability to carry this single style of skill over to the other cases which are very familiar to the trained human intelligence.

James goes on to say that the same distinction appears when we contrast a trained scientific mind with the ordinary mind. The ordinary thinker does not see how to deal with a situation in terms of scientific principles. James cites the example of his own experience with a smoking student lamp. He discovered by accident that the lamp would not smoke if he put something under the chimney so as to increase the air current, but he did not realize that what he had done was only one particular example of the general principle that combustion is favored by a large supply of oxygen. The general principle and its useful application belong to the sphere of thinking and experience which the untrained layman has not yet mastered.[1]

1. *Typical studies of transfer of training*

Some attempt has been made to solve this question by means of scientific experiment. For the sake of making clear the issues of the question and illustrating the types of experiment which have been tried, we may mention four typi-

[1] Judd, Chas. H. *Psychology of High-School Subjects*, pp. 413, 414. (Ginn & Co., 1915.)

cal experiments, two of which have led to conclusions unfavorable to transfer of training, and two of which have led to more favorable views.

Thorndike and Woodworth studied the transfer of the ability to make special judgments. The first experiment to be mentioned, and the one which constitutes the earliest attempt to attack this problem experimentally, was made by Thorndike and Woodworth. This, as well as the other experiments which are to be mentioned, are described in some detail by Heck, who also gives references by which they can be followed up to the original articles. Thorndike and Woodworth attempted to determine, among other things, the degree to which skill in judging lengths or areas would be carried over when one attempts to judge lengths which are different in extent, or areas which are different in size or shape from those which were used in the first practice. They found in most cases that there was improvement in judging those lengths or areas which were different in some measure from those on which the practice was made, but that the improvement was not so great as in the case of the original lengths or areas. They therefore took a critical attitude toward the possibility of transfer, and emphasized the smallness of the transfer, although it amounted in some cases to over thirty per cent.

Bagley found that neatness was not transferred. The second experiment led its author also to take the view that the amount of transfer of habits is so limited as to be of little importance. This experiment was made by Bagley under school conditions and with school subjects. Pupils of a class were trained for the purpose of bringing about an improvement in neatness in their arithmetic papers. After they had undergone a certain amount of training in this subject, their geography papers were examined to see whether they had also improved in neatness in this subject, and it appeared

that the improvement in neatness in the arithmetic papers was not carried over to the geography papers.

Coover and Angell found transfer in discrimination, which they attributed to improvement in attention. The two other experiments emphasize the existence of transfer and illustrate some of the methods by which it may take place. The first of these was conducted by Coover and Angell, and consisted in training a number of persons to discriminate between sounds of different degrees of loudness, and then in testing them before and after this training period in the ability to discriminate fine differences in shades of gray. They found a large amount of improvement in the discrimination of grays, and attributed it to an increase in the ability to disregard those features of the task which were not essential and to give attention to those which were.

Judd studied the importance of generalization in learning. The final experiment to be mentioned was made by Judd for the sake of determining whether the knowledge of the general principle which is involved in a task will enable one to profit by the experience when the conditions of the task are changed. He had two sets of boys trained in throwing darts at a target under water. According to the well-known principle of refraction of light, an object which is placed under water, and is viewed at an acute angle to the surface of the water, does not appear to be as far beneath the surface as it actually is. If a stick is placed in an oblique position in the water it appears to be bent for the same reason. When one attempts to hit a target seen in this position, one strikes too high and it is necessary to learn to readjust the aim in order to hit it. These two groups of boys were compared, one of them having been told this principle and the other not. In the first set of trials with the target at a given position, the two groups of boys did equally well. Those who had been told the principle had no advantage over the others. The

target was then placed at a different depth, which resulted in a different amount of displacement of its apparent position. The two groups then carried on a second series of trials, and in this case those who had learned the principle of refraction and its effect upon displacement, learned much more quickly than the other group. They were able to use the principle which had been taught them so as to take advantage of their experience in the earlier trials, and to readjust their mode of aiming in the second trial.

2. Points on which there is general agreement

We see from these illustrations, without going farther into a detailed description of other experiments, that there have been somewhat different results obtained from different methods, and by study of different kinds of learning, and that there have been various conclusions drawn from these experiments. We may sum up briefly the points upon which there is now a general agreement and those upon which there is difference of opinion, and then attempt to draw conclusions on the basis of experiments and of general psychological theory as to the extent to which we may expect transfer to take place.

It is generally agreed that there is some transfer of training. The earlier experiments led the investigators to report the smallness of the amount of transfer and thus to give the impression that improvement in one application of a mental function did not result from training in others. This appearance of denial of any transfer is due in a large measure to the fact that it followed upon the theory that the transfer was complete, that is, that training in one field would produce as much improvement in another field as in the field in which the training itself took place. In contrast with this extreme view, the smallness of the amount of transfer which might take place in certain cases led to an exaggeration of the

opposite view. The amount of transfer is not the same in all cases, but in most of the experiments, even in those of Thorndike and Woodworth's, some transfer of ability has been found.

There is commonly far from complete transfer. As has been already remarked, the amount of transfer is usually not so great as was formerly supposed on the old mental discipline theory. In some cases a large amount has been discovered. The improvement in the function which is not trained has sometimes been found to be almost as much as in that which has been trained. In general, however, we may expect a very much smaller amount of improvement when we transfer a function from one field in which it has been trained to another in which it has not been trained.

The amount of transfer varies widely with the conditions. This general conclusion must be qualified by the statement that the amount of transfer varies both with the kind of function which is trained, and the kind of subject-matter which is used, and with the way in which the training is given and the capacity and attitude of the learner. We do not think of mental discipline now as analogous to the development of the muscle. This is a common figure which was formerly used to illustrate mental training. It was thought that the memory could be developed in much the same way that a muscle is developed by exercise, and that as a muscle after having gained increased strength in one kind of work will show an equal amount of increase of strength in another kind of work, so the memory could be trained with one kind of subject-matter and show an equal gain with other kinds of material. It is now generally recognized that the training may under some conditions be very narrow in its results, or it may under other conditions be very much broader in its results. Whether it will be confined to the subject-matter which was originally employed will depend on

the way in which the learning is guided or directed, and upon the capacity of the learner to generalize and to profit widely by his experience.

3. Points of difference of opinion

Is a small amount of transfer important? While these conclusions will perhaps generally be accepted, there are certain points upon which there is still a good deal of difference of opinion. While it is agreed that the amount of transfer is not so great as was formerly thought, yet there is difference of opinion as to whether the smaller amount which is found to exist is important. Many hold that it is so small that it should not be taken into consideration in deciding what kind of training a pupil should have or what subjects he should study. Some believe that no subject can give a sufficient degree of general mental training to warrant its being retained or introduced into the school on that basis. If any subject cannot be shown to give a direct preparation for some particular activity of adult life, it is not, on this view, to be taught in the school, merely because it may be supposed it gives general mental development. On the other hand, there are those who believe that although the transfer may be very small in amount, yet it may be of sufficient importance to be of great value. Thorndike, who in his former writings minimized the importance of formal discipline or transfer of training, in his recent *Educational Psychology* [1] says that a fraction of one per cent of transfer may be important enough to make the attempt to develop the function distinctly worth while. He uses the illustration of the sense of fairness. "If a gain of fifty per cent in justice toward classmates in school affairs increased the general equitableness of a boy's behavior only one tenth of one per

[1] Thorndike, E. L. *Educational Psychology, Briefer Course*, p. 282. (Teachers College, Columbia University, 1914.)

cent, this disciplinary effect would still perhaps be worth more than the specific habits."

The structure of the brain does not furnish ground for disbelief in transfer. Some confusion of thinking exists with reference to the bearing of the facts of structure of the nervous system upon the possibility or probability of transfer, and it is therefore worth while to refer briefly to this matter. Heck in his *Mental Discipline* devotes a chapter to this subject and holds that the demonstrated fact in regard to the localization of functions in the brain make a transfer of training highly improbable if not impossible. The facts regarding localization have been briefly mentioned in a previous chapter. They give no warrant at all for such a view as this. As was indicated in the description of the different levels of the nervous system, the highest level, upon which we may expect the most significant transfer to take place, is the level on which the connection between the different parts of the nervous system is the most widespread. However much the simple sensory or motor functions may be localized in the nervous system, yet it is perfectly clear that any thought process, or any process of activity of any degree of complexity, requires the coöperation of a large number of parts or areas in the brain. As was pointed out before, the association areas, which bind together the different parts of the brain and enable them to work in conjunction with one another, constitute the distinctive feature of the human brain. Take a comparatively simple intellectual act, such as writing. In this we use the motor centers which control the hand, and the motor centers which control the movements of the eyes, as well as those which make possible the maintenance of position of the rest of the body. We use the language center which enables us to imagine the pronunciation of a word or to pronounce the word inwardly; the center for hearing which makes possible

the ability to imagine how the word sounds; and the center of vision which governs our perception of the word or the presentation to our mind of the image of the appearance of the word. Finally, there is involved in addition to all these, the activity of whatever centers may be involved in the idea as distinguished from the mere mechanics of the word itself. We have here the coöperation of a pretty large share of the brain, and there is manifest a system of connection which renders absurd any view that training may take place through the development of any single localized area.

Is transfer possible only through ideals or some other single mental process? Another point upon which there is not entire agreement is in regard to the kinds of mental activity in which transfer may be expected to take place. This may be illustrated in a single case from Bagley's experiment with neatness. As a result of such facts as appeared in this experiment Bagley concluded that a mere habit does not carry over from one field to another, but that if there is developed, in addition to the habit, an ideal with reference to a certain kind of conduct, this ideal may lead to the development of similar conduct in another field. Judd, as we have seen, makes generalization the important means by which the results of training can be transferred, and Thorndike holds that transfer can best be explained by the existence of identical elements in the mental processes. We shall have to raise the question whether any one formula is sufficient to furnish an explanation for all kinds of transfer.

4. The various forms of transfer

Transfer may be positive or negative. Before entering upon the discussion of the different forms of transfer in detail, it will be well to make a distinction which is sometimes overlooked. The relationship between different mental functions or between a mental function in one sphere and in

another may be of two different and opposite sorts. The result of training in one field may be the increase of ability in another field, or it may result in the decrease of that ability. It is a matter of general observation that a person who has specialized in a profession often becomes thereby unfitted in a certain measure for commercial life. Certain professions are notoriously regarded as making their members easy victims for all sorts of financial and business sharpers. In such cases there is transfer of training, but it is of a negative sort. Transfer is positive when improvement in one function facilitates improvement in another, and it is negative when training in one function interferes with another. Whether training is positive or negative, it indicates a relationship between different functions of our mental life or between the applications of a function in different fields.

5. Transfer through common elements

Some kinds of transfer may be described in terms of elements. A partial account of many of our mental activities, especially the simpler ones, may be given by describing them as made up of elements. Some kinds of learning consist largely of the combination of a number of movements, or of the recognition or perception of objects, or of a series of associations which are made between objects and certain responses. The simpler kinds of transfer may be described as taking place between two different activities which have in common one or another of these kinds of elements.

Movements transferred from one activity to another may produce negative transfer. We may distinguish several kinds of transfer which can be described as due to the presence of common elements. In the first place, a movement which has been learned in response to one stimulus may be transferred bodily to another situation so that it is made in response to a different stimulus. For example, if a person

who has learned to make a certain stroke in batting the ball in a game of baseball learns to play golf, he may use the same form of stroke in the new game. But if he does he will find that his progress is hindered, since a different kind of stroke is needed in the latter game. Instead of making a sharp hit in golf, one should make a long sweeping stroke. Another illustration may be taken from piano and organ playing. If one has learned to play the piano first and then learns to play the organ, he is likely to carry over to the organ the sharp, sudden blow he has learned on the piano, instead of exerting a sustained pressure. It is clear that the benefit to be drawn from carrying over movements from one activity to another depends upon their suitability in the second case. The fact that a movement has been used in a former activity may be a hindrance rather than a help when it is transferred.

The presence of the same stimuli in two situations may cause interference. Instead of carrying over the same movements from one field to another, one may find it necessary to respond to the same stimulus in a second task as in the first, but by a different movement than that which was learned in the former task. This kind of reconstruction of the association between a movement and a stimulus is illustrated in card sorting. Experiments have been made of the following nature. A pack of cards which contains several series numbered from *one* to *ten*, and arranged in the pack in chance order, may be sorted according to number by placing them in a series of piles. These piles may be arranged so that they do not come in serial order, as in the illustration: —

3	2	5	1	7
9	4	6	10	8

After one has developed considerable ability in sorting the cards with the numbers in one order, the order may be

changed. In this case one is required to respond to the same numbers as before, but by different movements. The same change would be illustrated if a mail clerk had become accustomed to sorting letters with the names arranged on the boxes in a certain order, and then was required to change his habit because of a shift in the arrangement of the names. In such a case the presence of the same stimulus in the two tasks acts rather as a hindrance than as a help. If an entirely new set of stimuli were used, one would profit by his first experience because he would have gained familiarity with the process of handling the pack, and with the general methods of procedure in sorting. When the experiment is carried far enough, these sources of improvement outweigh the difficulty which is due to a change in the order of the numbers, but the mere fact of the identity of the elements in this case may act as an interference when they are associated with different movements.

Simple, elementary associations between stimuli and movements are sometimes applicable in a variety of situations. There are various kinds of elementary associations which may be similar or identical in different activities and which may serve as a means of facilitating or interfering with progress. In learning to use the typewriter one makes associations between the sight and the thought of the letters, and the keys which are to be pressed; or in learning to play the piano, one associates the notes on the score with the keys on the piano. In learning to spell one associates the idea of a word with the group of letters which represent it on the printed or written page. In all of these cases the formation of these simpler associations will facilitate progress. The formation of the individual association is not the whole matter. One must also learn to put the individual associations together into groups, as we saw in the description of learning to use the typewriter; but the association

between the sight of an *a* and the pressing of a key is common to writing the word *and*, and the word *hat*, the word *man*, and so on. This association will, if learned in one connection as in writing one particular word, be useful when it is transferred to a somewhat different set of associations. If one learns to spell words in a column test it will enable him the better to spell words in composition. There is thus a transfer of associations from one situation to another. Other cases of transfer of the same general nature we assume as a matter of course. If one learns to recognize a word in one connection, he will be able to recognize the word in another connection with a probability of some loss due to change of association. If one learns the meaning of a series of foreign words in a vocabulary, he will be able to interpret the meaning of those words again, with some loss due to the changed surroundings, when he reads them in a context. And so we may assume in general that the presence of elements of this sort in two situations will serve to make the training in one facilitate progress in the other.

The relationship of the elements which are common to two forms of learning is often the most important thing. We see from a survey of the different way in which elements may combine in different kinds of bodily and mental activity that no single formula can be used to predict what will be the result. We must know not merely what the elements are in the two cases, but in a still more important degree we must know what the relationship of the elements in the different situations is. In some cases the presence of the same element may assist learning and in other cases it may be a hindrance. It is necessary to examine each form of learning for itself and to determine how far elements which have been learned in previous experiences may be of assistance, or how far they may be a hindrance.

6. *Transfer through development of attitudes*

Illustration from attention. The relationship between a mental function or an activity in different situations is not by any means adequately described when we have traced certain common elements in the different cases. Another very important kind of relationship or union between various applications of a mental function is due to the fact that there is developed by means of the exercise of the mental function a more general attitude or set of mind, as well as a series of particular habits. A variety of illustrations of this principle may be found. We may take one from the experiment of Coover and Angell which has already been mentioned. The explanation of the transfer from training in discrimination of sound to improvement in discrimination of shades of gray was that the learners acquired the ability better to direct their attention. This consisted in a large measure in the attitude which they developed toward distraction. A person may learn instantly to turn his attention away from a stimulus which would distract him from the task which he has in mind, and when he has developed this attitude of mind, he has acquired an important condition of efficiency in mental work.

Apperception is largely due to attitudes which are developed. The attitude which is developed through education may be expressed in paying attention to certain things rather than others. It is a commonplace of observation that different persons who are confronted by the same objects may see very different things in them. We have become familiar with this process under the name apperception. We say that a person sees in a thing what he has been prepared to see by his previous experience or his cast of mind. Thus through the training of one's profession one acquires the habit of picking out certain things to pay at-

tention to and to think about. A physician notes the signs of disease, the teacher pays particular attention to children and their characteristics, the clothing merchant notices particularly the dress which persons wear, and so on indefinitely. This we may describe as due to the development of a general attitude of mind.

One may develop predominately an analytical, an appreciative, or a practical attitude. This development of an attitude of mind may be very general in its nature. A person may acquire the habit of viewing things from an intellectual viewpoint. The questions which are aroused in his mind by his experiences may be largely those which are concerned with the explanation of the facts which he observes. We say that such a person is analytical. He is trying continually to account for the actions of persons or of the physical events of the world about him. Another person, on the other hand, may have what we call the appreciative attitude of mind. He may continually be seeking to weigh what he sees in terms of beauty or ugliness. Artists have predominantly this attitude of mind. If an artist sees a landscape, he picks out the elements of beauty or ugliness in it, whereas the person of the intellectual or analytical attitude of mind may attempt to explain the geological formation or some other scientific aspect of such a landscape. Still another person may have the practical attitude. His question may always be of the money value of objects which he observes or of the use to which they may be put in satisfying human needs. We have the testimony of the scientist, Charles Darwin, that the development of the analytical or scientific attitude of mind in his own case interfered with or displaced the development of the appreciative attitude. He remarked that while in his early years he was very fond of poetry, in his later years he could not endure any lengthy reading of this type of literature, and he deplored

the fact that one attitude of mind has usurped the place of the other.

The scientific attitude may be developed as a special form of the intellectual attitude. The intellectual attitude may also include a variety of more particular attitudes. We say that a person is scientific in his attitude when he is open-minded, when he is willing to give consideration to new facts or new ways of interpreting facts. We include in this scientific attitude the disposition to seek evidence before forming one's opinion, to verify one's conclusions instead of jumping at them, to substitute reason for sentimentality, and so on.

Differences in social attitude are general in their nature. As a final illustration of the development of attitudes we may take the attitudes which a person assumes toward other persons. These have been referred to in the chapter on the social instincts of the child. For example, one may have predominately an attitude of dominance or one of submission. This is partly due to one's natural temper of mind, or it may be partly due to education. A person who has been continually treated as a slave is likely to acquire a submissive attitude. Again, there may be a general attitude of fairness, or of unfairness and prejudice in one's dealings with others. One may have developed the courteous way of treating other persons, or may be rude and discourteous. One may develop a habit of truthfulness or a habit of shiftiness with reference to the truth.

General attitudes are subject to the influence of education. The application of these facts to the problem of the transfer of training raises the question of the extent to which they may be developed by education. One may certainly conclude, without going into the matter in detail, that such attitudes may to some extent be modified and developed by education. Since the experiments on transfer of training have dealt largely with more specialized capacities, it is

difficult to estimate with any degree of definiteness how far such attitudes of mind may be developed in general, and how far when they are developed they become a part of one's attitude toward all situations. In some cases it is desirable that they should not be applied to all situations. The case of Darwin suggests the conclusion that it may be desirable in some measure to develop various attitudes each of which might be manifested with reference to the particular kind of situation in which it is appropriate. One could develop the appreciative attitude toward poetry, music, and art in general, and the scientific attitude toward facts of science, which are to be apprehended through rational processes. It is a mistake to develop either attitude in the situation for which the other is appropriate. There is therefore in some cases too much or too general transfer of training in attitudes of mind.

Mental control is a general attitude which may be increased by education. In the next chapter a type of mental attitude which has not been included in this survey will be dwelt upon, which is of large importance, and which undoubtedly can be developed. This is an attitude which we may describe in general terms as one of mental control, and its opposite consists in various forms of lack of control which are manifested in either temporary or permanent nervousness, lack of self-confidence, etc. That these are amenable to treatment is the general opinion of experts in this field.

Conclusion regarding attitudes. We may conclude that attitudes of mind of this sort are among the more important means by which different particular mental functions are brought into relationship to one another; and although we cannot at the present time define the exact degree to which they are subject to training, yet it is undoubtedly true that they are to a large extent so susceptible.

Self-conscious attitudes or ideals. General attitudes of

mind which are still more definitely under control of education may be developed. In the above description of attitudes nothing has been said regarding the person's knowledge that he possesses these attitudes. Such attitudes of mind may exist in a person without his thinking particularly about it. We may, however, contrast such cases with those cases in which a person not only develops an attitude of mind, but also becomes conscious of it, and deliberately attempts to develop or modify it. A person may not only learn to be industrious but he may learn to value industry. He may develop the ideal of industry. This ideal consists in the notion that industry is worthier and more valuable than sloth and is therefore desirable. Many of the attitudes which are described in the previous section may be ideals, as well as unconscious attitudes.

Illustration from the ideal of accuracy in manual training. The development of an ideal, and its transfer to other situations than the one in connection with which it was originally developed, may be illustrated in the matter of accuracy. Suppose that a student in the manual training shop has learned that in order that boards may be fitted together in accordance with the plan, they must be sawn and planed accurately. If the work is not done accurately the article which is being made will clearly show it. The result of inaccuracy will then strike the attention of the student, and if he is at all awake to the results of his experience, he will realize that in the field of manual training, at least, it is necessary to work with care and precision. In other words, the student has developed an idea of the value of a particular quality of mind and action. In the future when he is confronted with a problem of the same sort, he may strive to work with greater accuracy because of the fact that he has realized its value in his past experience. This will not mean that he will be capable at a stroke of equaling the accuracy

of a skilled worker, but it will mean that the idea of its value will so stimulate him that he will improve more rapidly in skill than he otherwise would. The extent to which he is able to generalize on his experience will determine the breadth of the application which he can make of this idea. He may apply it only to manual training, or he may apply it to other sorts of study, or to other sorts of work in general. This is an illustration of the statement which was made earlier that training may result in transfer or it may not, according to the attitude of the learner.

7. General ideas which illuminate the mode of procedure

Ideas of method are more specific guides in learning than mere ideals. The development of an ideal or an idea of value in one task stimulates the learner to attempt to attain results which are esteemed valuable in other tasks which he has to perform. It does not, however, give him information as to the method by which he can best obtain the improved ability. It furnishes him with the motive to attempt to attain a particular kind of ability, or to choose one kind of response to a situation in contrast to another. To recur to our example, the ideal may lead him to choose to make the effort to be careful and accurate, in place of being careless and inaccurate. It may lead him to attempt to work industriously and persistently in place of making half-hearted and spasmodic efforts. But in addition to such stimulus to effort, training may also affect the learner's responses in a general way by giving him ideas regarding the best mode of procedure to attain the result he desires. Assuming that one is aware of the value of certain attainments, these ideas will indicate how most quickly to attain the result.

Illustrations of transfer through ideas of method. The development of the idea of a mode of procedure as distinguished from the idea of the value of the result may be illustrated

from modes of learning which have been already described. It has been shown that in memorizing it is more economical to distribute one's time and practice into comparatively short periods, and to allow some interval of time between periods of practice. One may learn this better mode of distribution of time as a result of his attempt to memorize, and he may then apply the same method of procedure to other forms of learning. One may also discover in his experiments in learning that it is necessary to acquire the ability to avoid distraction, and he may then apply the knowledge of this principle to every form of learning which he undertakes. He may discover also that it is desirable to disregard fatigue or its symptoms up to a certain point, but that under certain circumstances, or beyond a certain point, the feelings of weariness which accumulate should be taken into account. Finally one may discover and confirm in one's experience the principles of scientific method, and may then apply these principles in other fields of work.

Training in general principles may be much more widely applied than narrow technical training. In addition to notions of the best methods of procedure, the learner may also develop ideas regarding the principles which govern the material or the subject-matter with which he is working, and may so generalize these principles that he will be able to apply them broadly, at least within the field of the general subject which he is studying. Judd's experiment with the dart throwing illustrates this kind of general notion and the way in which it may be applied to produce transfer of training. In general, the person who develops such principles as a result of his experience is the one who has had a broad scientific training in his subject rather than a narrow, rule of thumb sort of training. We may distinguish the artisan who has learned to perform a number of particular processes and has become skilled in them, but is not acquainted with the

more general principles of his work, from the person of broad training, such as the engineer, who is not merely skilled — or perhaps not skilled at all — in performing the various details of work in his field, but who has such a grasp of general principles that he can attack new problems and develop a new method of dealing with them. A person of the narrow kind of training would be able to repair a machine with which he was familiar, or which was rather similar to one with which he was familiar; but one who had the broader training would be able to apply his knowledge to repairing any kind of machine, or at least a very much wider variety of kinds of machines.

We may apply the same distinction to methods of training teachers. One method which may be pursued in training teachers is to give the teacher a large number of rules of thumb to direct his method of teaching each subject in detail, or to give rules for the administration of the class-room and for all of the particular duties which have to be performed. On the other hand, the training may be of such a sort that it will give the teacher an appreciation of the general problems of education so far as they affect the class-room work; for example, an insight into the mode in which the child attains his mental development, the kind of development which takes place in the various kinds of study, or the differences in development which one may expect in different children.

Both general and specific training are desirable. Both of these kinds of training are desirable. If the teacher is given merely a series of rules of thumb, he will be at a loss when these rules do not apply, or will find it difficult to know how to apply the rules in individual cases. The teacher in this case will have a training which may fit him for a special set of circumstances but which will not give a preparation for dealing with a large variety of circumstances or for applying

the results of the experiences in one case to other cases. On the other hand, a training which is merely general in its character such as that which is got from a study of educational psychology, leaves the teacher who begins with this preparation alone with the necessity of working out the methods of applying the principles in detail. This means that there is some loss of time and waste of energy in acquiring devices and specialized methods. Both sorts of training are necessary, but the point that is here made is that the training in broad general principles is the kind which will enable the student to carry over the result of experience in one field to other fields of endeavor.

8. *The application of the facts of transfer*

Both the amount and the importance of transferred training must be considered. It may be accepted as a sound conclusion that training is to a greater or less extent general in its scope. Several principles should be taken into account in attempting to work out the practical application of this conclusion. The first one has already been mentioned in a previous paragraph. We cannot judge of the value of the general effect of special training merely upon a knowledge of the percentage of improvement which occurs in a related field as a result of training in another field. We must also know how important this transferred effect is, and whether it could be attained more effectively in this or in some other form of training. If a form of general training is very desirable, and if it cannot be more effectively or more economically developed in some other way, then the effort to reach it through a particular kind of training, or through the teaching of a particular subject, may be justified, even although the amount of development in general intellectual ability which comes as a result is very minute. Thus if a person as a result of scientific training develops even to a slight degree a general

idea of the scientific attitude or of the scientific method, so that he can apply it in the general problems of his life, the result may justify the effort which has been expended. If such an idea leads a person, as a citizen, to endeavor a little more carefully to get at the real facts of the social or political situation, in order to enable him to vote intelligently, the value of the result will be very great. It may be sufficient to decide his choice in an important election.

Both specific and general training are necessary. On the other hand, to use the illustration which has just been cited, because a general scientific training might make a person more judicial in his survey of civic facts, and might enable him to vote more intelligently, this would not justify a neglect of more specific training which would have more direct bearing upon the problems of citizenship. This illustrates the error of substituting general training for more specific training in those cases in which the specific training could be given and would be of value to a large number of pupils. General training is not to be considered a satisfactory substitute for special training in those cases in which we know the sort of special training which is appropriate and can give this training to the pupil.

Considerations of formal training should probably not often be a deciding factor in the choice of studies. In order to determine what subjects shall be included in the course of study it is always necessary to consider the specific or direct value to the pupils of the skill or knowledge which they gain in their pursuit. Reading is taught in the school because it is highly important for the pupil to be able to read in gaining further education, and in pursuing his business and recreation in after life. Music and literature are included because the enjoyment of these arts contribute to the pleasure and contentment of the individual and to his human sympathy and understanding. And so we might catalogue the valuable

results in specific attainment which are produced in the study of various subjects. But the presence of certain subjects, for example grammar, the ancient languages, much of mathematics, and to some extent science and manual training, has often been justified, not because of their direct, but of their transferred value. But the possibility of generalized training is not confined to certain subjects. All subjects possess it at least in some degree. The degree of generalized training to be gained from a subject is more dependent on the way it is organized and taught than upon the subject itself. To justify the introduction or retention of a subject which has little or no direct value, then, it is necessary to show that its value for general training is overwhelmingly greater than that of its rivals. In spite of our conclusion that general training is a fact, and an important one, it is questionable whether it is of sufficient importance by itself to decide the choice of subjects unless it is combined with large direct value.

The appropriate kind of general training in each subject should be emphasized. The fact that general training does not result automatically from the teaching of subjects but only results when the subject is taught in a certain way, means that the teacher, in the selection of topics, and the mode of presentation of the topics, or the kind of work which shall be assigned to the student, must take into account the general result as well as the special knowledge or skill which is to be developed by the study. This means also that the teacher must carefully consider the kind of general training which should be expected from a particular study. One should not expect to develop any great appreciation of beauty from the study of mathematics, or the development of the scientific method from the study of literature. Each subject of study has its own appropriate kind of mental attitude which is to be developed in it. While in any particular subject there may be opportunity for the development of a

great variety of attitudes, yet most of these are of such minor importance in any one particular study, that not much general result can be expected from their development. It is necessary then to get clearly in mind the form of general training which is to be expected from any particular subject and so present it that this type of general training will be most effectively produced.

QUESTIONS AND TOPICS FOR DISCUSSION

1. Illustrate the difference between form and content in learning.
2. If no transfer of training is found in a particular experiment, what is indicated with reference to the possibility of transfer?
3. What is the practical application of the fact that the amount of transfer is usually small? Does it mean that the transfer of ability is not important?
4. What is the practical application of the fact that the amount of transfer varies with the conditions?
5. What does negative transfer or interference show with reference to the view that the mind is made up of many highly independent elements?
6. Does an association, as represented by spelling a word, carry over without loss from one set of circumstances to another? For example, is a word which is learned in a column test always spelled correctly in sentences?
7. Name a specific attitude which is formed when the student learns to concentrate his attention.
8. How, in general, are attitudes, such as the analytical or the appreciative, formed? What produces them?
9. Is it always desirable to make attitudes self-conscious?
10. What is the effect of making attitudes self-conscious upon the extent to which they become general?
11. What is the limitation upon the successful generalization of ideas of method? May such generalization ever be disadvantageous?
12. Discuss the illustration from James given in the quotation from Judd in the early part of the chapter from the point of view of the specialization of scientific training.
13. Should teacher training be entirely specific, or may the teacher legitimately be left to make some of the application of general principles?

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CHAPTER XIV

MENTAL ECONOMY AND CONTROL, MENTAL HYGIENE

This chapter deals with economy in mental energy. In discussing the most effective methods of learning, we considered to some extent the question of mental economy, — that is, we raised the question as to the most economical way in which one's time and energy can be applied in order to produce the most rapid learning. We may also raise this question with reference to accomplishment in general as well as with reference to rapidity of improvement. We shall therefore in this chapter discuss those principles which govern the most effective or economical performance of mental work, whether it has to do with improvement, or with accomplishment at a particular level of ability. We may also raise somewhat more general questions which are appropriate to the topic of mental hygiene. How may we avoid friction or waste of energy through useless acts or useless feelings or emotions? How may we avoid any sort of expenditure of energy which has no fruitful result?

1. Fatigue

Mental economy was formerly thought of chiefly as the avoidance of fatigue. This subject of mental economy was formerly approached largely through the study of fatigue. Work was thought of as producing a certain definite amount of fatigue, proportional to the amount or the strenuousness of the work. Fatigue was regarded as the loss of a certain definite amount of energy which could be measured. From this point of view the determination of the principles of mental economy would consist in finding out the amount of

fatigue which was produced by work of various sorts or under various conditions, and the best method which might be used to avoid or minimize fatigue.

Typical studies of fatigue are those of Griesbach and Kraepelin. This problem was applied to education in the investigation of the German scientist Griesbach, who attempted to measure the fatigue in school children at various times during the day by measuring the fineness of discrimination between two points of contact on the skin. Griesbach thought that he could measure accurately the loss of mental energy resulting from school work by this method. Later studies, however, showed that the ability of the school child did not drop off in anything like the manner that Griesbach thought had been determined by his studies. Another application of the investigations of fatigue has been made by the German scientist, Kraepelin, and his followers, who have attempted to account for the changes in the efficiency with which one works at different parts of the work period or the practice period, by analyzing the total output of work as due to changes in fatigue, in practice, in warming up, in spurting, and so on. This work throws some light on the causes of changes in efficiency and indicates that fatigue is only one of these causes.

Winch, Thorndike, and Heck find that fatigue is less than is commonly supposed. Fatigue is undoubtedly one of the factors which affects the efficiency of our work; but recent studies with school children have indicated that the amount of fatigue which we may expect to appear as a result of the ordinary work of the school day is much less than was formerly supposed. Winch, in England, found that children who practiced solving arithmetic problems on successive days in the early forenoon gained about 5 per cent more than another group which practiced in the late forenoon. Heck gave tests to school children at four periods during

the day; between 9 A.M. and 9.30 A.M., between 11 A.M. and 11.30 A.M., shortly after 1 P.M. and about 2.30 P.M. It appears from this experiment that the amount of work done increased in the later periods while the accuracy decreased, but there does not appear to be any large decrease in efficiency due to fatigue. The following table shows typical results from one school: —

TABLE V. THE PERCENTAGE OF EFFICIENCY OF SCHOOL-CHILDREN AT FOUR PERIODS, TAKING THE PERFORMANCE AT THE FIRST PERIOD AS 100 PER CENT

	Periods			
	1	*2*	*3*	*4*
Amount done	100	100.72	103.63	101.70
Accuracy	100	96.69	95.64	96.38

Fatigue is measured by the decrease of efficiency due to activity. In order to estimate properly the meaning of these new facts and to decide how important fatigue is in reducing our mental efficiency, we must get clearly in mind what is meant by the term fatigue. Mental fatigue may be taken to mean several different things. In its most accurate and technical sense it means the falling off in the ability to do mental work either in accuracy, or in speed, or in a combination of both, as a result of mental or physical exercise. The term is ordinarily applied to the result of mental rather than physical work. Fatigue in this sense could be measured by comparing the amount of work which one can do at the beginning and at the end of a day of continued activity, or by comparing the amount one can do at the beginning and the end of a week. This simple comparison does not take account of any difference that might occur through practice. Hence

if a person is improving rapidly in his ability in the work he is performing, it is necessary to allow for this and to compare not merely the work at the beginning of the day with the end of the same day, but also the end of the day's work with the beginning of the next day's work after rest; or the end of the week with the beginning of the next week after an interval of rest.

Fatigue in the strict sense is to be distinguished from the feeling of weariness. This method does not measure what we very often mean by fatigue; and the studies which have been made of fatigue in the laboratory do not take account of some of the results of work which we ordinarily think of when we say that we are fatigued. We commonly refer by this word not merely to the diminished efficiency of our work but also to the feelings of weariness which result from continued work. These feelings of weariness are admitted to have an effect upon one's ability to do work, but in the laboratory test their effect is undoubtedly much less than it is in the ordinary work in which one is not undergoing a special test. While the diminution in efficiency which is shown or appears at the end of an ordinary day's work might be less if one attempted to work at his top speed, yet it is a real diminution and is to be reckoned as the ordinary result of the feelings of weariness which appear in work which is not done under laboratory conditions. It is worth while to have discovered, however, that one may to a certain extent disregard these feelings and that one's work may not necessarily diminish to the same extent that it does in everyday life because of the unpleasant feelings which are produced by work.

The course of physical fatigue is relatively simple, as shown by experiments with the ergograph. The difference between the modern and the older view of fatigue is partly to be explained by the fact that the earliest studies had to do with physical fatigue, and that the course of physical fatigue,

at least so far as it has been measured, seems to be different from that of mental fatigue. The classical experiment on physical fatigue was made by the Italian scientist, Mosso, who used an instrument called the ergograph, by which he could measure the ability of a person to raise a weight with one finger. The experiment is conducted by requiring a person to raise a weight repeatedly either as rapidly as he can or at a certain regular interval. If the weight is sufficient to necessitate considerable effort, the height to which it is to be raised rapidly diminishes until finally one is unable for a time to raise it at all.

The course of mental fatigue is more complex. The change in efficiency in mental work throughout a period of work is very much less simple than this. Sometimes one's score rises throughout the period of work instead of falling, as we should expect it to do as the result of fatigue. Sometimes it falls rapidly at the beginning, then rises and falls toward the end. Sometimes there is a gradual falling toward the end and then a rise just before the end. There are also differences according to the kind of work or the individual peculiarity of the worker.

Various factors contribute to the decrease in efficiency of mental work. There is not space here to go into details in the discussion of the causes of these various changes in the work curve. We may say, however, that the curve is very largely governed by one's attitude toward the work, as well as by his ability. Interest may cause the curve to rise or the falling off of interest may cause it to drop. When one has worked for several hours, he may become bored with what he is doing and be very desirous of dropping it and doing something else. If he is furnished with some new interest or some new reason for putting forth effort, he may show that his ability has fallen off very little, if any. This distaste for work is due partly to physical conditions. There may be an accumula-

tion of restlessness which results in an impulse to get up and move about, if the work is such as requires sitting or remaining in the same position. The mere continuance of an activity of the same sort seems to cause a desire to do something different even though it is another kind of work. In the chapter on transfer of training we saw that general training in mental work consists partly in learning to disregard distractions which arise from such impulses as these.

The child should gradually learn to work persistently. When applying these facts to the conduct of work of the pupils in the school, it is clear that we must be careful not to conclude too readily that the pupil's real ability to work has fallen off as a result of his school work. Before such a conclusion is drawn, we must have taken care to see that the pupil's interest is maintained and that he is given sufficient motive to put forth effort in his work. The pupil needs to be trained gradually to disregard the slight inconveniences which appear as a result of prolonged work, just as does the adult worker. On the other hand, we must make allowance for the greater sensitiveness of the child to the distractions which would divert his mind from his work, and his less ability to work in spite of them. It would be a mistake to conclude that the child is able to maintain the same level of efficient work as the adult person under the conditions of a laboratory experiment.

Fatigue probably affects some kinds of work more than others. We must also recognize, in applying these facts to school work, that a small amount of fatigue may have a widely different effect upon some kinds of work than upon others. In all probability it will affect very much more new forms of learning and those which are difficult, than the performance of work in which the individual is fairly well practiced, or which is easy for him. For this reason, although the fatigue at the end of the day is not great, it is necessary to

take it into account in arranging the program of the day so that the easier studies come toward the end. It is impossible to say what subjects should be put at the end since no studies of sufficient accuracy have been made to determine which are most affected by fatigue.

Weariness is not to be completely ignored. It is necessary to consider the significance of the feelings of weariness as indicative of the effect of work upon health or upon the permanent physical condition as well as upon immediate efficiency. It is possible that one may be able to disregard feelings of weariness and maintain his efficiency for the time being, and still be overworking, or be injuriously affecting his health. It is necessary to consider this particularly with children. The problem of health is of double importance in their case. The impairment of health in the child does not merely mean temporary loss of efficiency, but also means a loss in growth and development. The problem before us is to know when the feelings of weariness have reached a point at which one should pay attention to them and govern one's work according to them, and when, on the contrary, it is necessary to disregard them, and work energetically in spite of them.

Permanent weariness is a sign of a harmful degree of fatigue. There are several ways in which we can learn to discriminate between the feelings of weariness which should be ignored and those which are symptoms of debilitated bodily condition, and therefore need to be heeded by a modification of the conditions of work. In the first place we may distinguish between a temporary feeling which does not remain from one day to another and a more permanent feeling which lasts for days and weeks and seems to be independent of the amount of work which is done. A permanent feeling of lassitude, particularly if it appears in the morning before any work has been done, is likely to be a sign which

should be given careful attention. This, of course, is to be distinguished from the slight feeling of lassitude which occurs on first rising in the morning before one is fully awake or before the circulation has become vigorous. In the case of the school child it is not difficult to recognize permanent weariness, since by the time work is fairly started the early morning lassitude should have disappeared.

Undue fatigue is manifested also in physical symptoms. If there is doubt as to whether a feeling of weariness is due to an injurious effect of overwork or of work under the wrong conditions, or whether it is due merely to a natural result of work, or even of laziness, the feelings can be checked up by certain other symptoms. If one is overworking, the effect will be seen commonly in more strictly physical symptoms. It may be seen in the loss of appetite, in the poor assimilation or digestion of food, in loss of weight or in anæmia. If a permanent feeling of lassitude is accompanied by some of these physical signs, there is reason to believe either that one is overworking or that the conditions under which one works are not correct, — that is, that one is not living under the correct general conditions of hygiene. It is therefore desirable to keep a record of the child's height, weight and physical condition in order to detect signs of overwork.

2. *Planning and organizing work*

The feeling of weariness is a factor to be considered in planning work, but not in carrying out the plan. The suggestion that feelings of weariness are to be checked up by noticing whether they are temporary or permanent and by taking account of physical symptoms, leads to the remark that such feelings should be taken account of, not while one is working, for the purpose of enabling one to decide whether he should continue or break off work at a particular time, but that they should rather be taken account of at only the time

when one is planning one's work. This is the solution of the problem which is raised by the necessity of taking due account of the feelings of weariness without at the same time allowing them to have an injurious effect upon one's concentration and efficiency. One who is continually examining his feelings while he is working, to find out whether they are of such a sort as to justify stopping work or taking a rest, has destroyed the fundamental conditions for efficient work. He creates for himself all sorts of imaginary feelings, and exaggerates those feelings which he has to such a degree as to make it utterly impossible to decide what the significance of his feelings are. It is, however, entirely justifiable to take account of one's feelings in planning work, since they can then be seen in their proper perspective.

Children should gradually learn to plan their work. The application of this principle to the education of children in habits of work means that they should not be encouraged to pay any attention to their feelings of weariness which are caused by their work until they have reached the point where they begin to plan their own work schedule. Before this time the teacher or parent must decide from the objective symptoms how much the child can endure without injury. The child may be given some responsibility for planning some of his work in the upper years of the elementary school period when he begins to do home work. Here and in the high school he should learn to study himself and find out the conditions under which he can do work of the largest amount and best quality.

Plans should include due amounts of rest, recreation, exercise, and food. In planning work either for one's self or for a group of children, one should make provision for all the necessary conditions of health as well as of accomplishment. For this purpose it is necessary to provide not merely for the hours of work, but also for due amount and proper distribu-

tion of rest, recreation, exercise, and food. The amount of food, rest, exercise, and work which is important for different persons differs, and it differs for children of different ages. One should determine what the best amount is in each case by experimentation. Each person needs to determine this for himself. He cannot merely apply to himself general rules, although these may serve as a rough guide.

Plans should be tested consistently and only modified deliberately. The proper procedure is to make out a tentative plan and then try this plan for a certain length of time, — a week or a month, — and see how it works with reference to feelings of well-being, and with reference to the more external symptoms which have been mentioned, and to the quality of the work which one is able to perform. If at the end of the set period it seems desirable to modify the schedule in some way, this should be done, and then the modified schedule tried out in the same manner. While the schedule is being worked, one should give one's whole mind to the thing which is being done in the time which is assigned for it. In this way one will attain concentration of mind and at the same time avoid the danger of overdoing at the expense of health.

Planning work promotes concentration. A plan of work should include a schedule of the kind of work which is to be done in different periods as well as a schedule of periods during which the work shall be done. The reason for planning in detail both the general and the detailed schedule is that this makes possible a greater concentration of attention. The difficulty which arises when the work is not definitely planned is that one cannot settle down to a particular task with the highest degree of calm. If the worker has not determined beforehand how long he will work, he will before long begin to raise the question with himself whether he has worked long enough. As soon as he has begun this process,

his mind is divided, and efficient work for the rest of the period is prevented. Somewhat the same difficulty arises when one has not beforehand decided *what* work shall be done in a given period. If both elements have been determined beforehand, one has the assurance in taking up a certain task that there will be time to accomplish it, and further that there will be time to accomplish the other tasks.

Preoccupation with the present task is a condition of healthy-mindedness. Such an orderly procedure as this, because of the fact that it makes possible more concentrated work and a calmer attitude of mind, makes the work less fatiguing. It reduces the inner friction which leads to nervousness and to the unnecessary application of effort without corresponding results in accomplishment. The single-minded absorption in what one is doing makes for mental health in general as well as for efficient work in a particular task. We may lay it down as a general principle that in order that one should be healthy-minded it is necessary to be chiefly absorbed in the present, and in performing one's present duties, rather than to be preoccupied with the past or with the future. A good illustration of the harmful consequences of preoccupation with either the past or the future may be taken from the game of golf.

Illustration from golf. It is a matter of common knowledge among golf players that a poor stroke is apt to have a very much more serious consequence than that which follows merely from the lowering of the score by that one stroke, or by its objective consequences. The reason that a poor stroke is often serious is that the player is not able to forget it. It might be very easy to overcome it without any loss in score at all; but, after the player has made such a stroke, the worry which ensues in his mind leads him to make a whole series of other poor strokes, and this seriously lowers his score. If he could have entirely forgotten the poor stroke, he

might have completely overcome the disadvantage which it caused. An illustration of preoccupation with the future may also be taken from golf. If a player has proceeded most of the way around the course and has made an unusually good score, he is apt to begin to look forward to a final low score. He conjures up in his mind visions of breaking his record or of surprising his friends with the low score which he is to make. As soon as this idea takes possession of his mind his game is very liable to suffer seriously; and it frequently happens that while one might with ordinary play get a very low score, the appearance of such an idea causes one's game to go to pieces completely. The general principle, of which all golf players are aware, is that, in order to play well, it is necessary that one be absorbed in the thing he is doing at the moment, rather than be preoccupied with any more remote consideration either of a pleasant or an unpleasant sort. This point is put very clearly by Jerome D. Travers, open golf champion of the United States: "There is one thing that has helped me more in the match play than any other factor, and that is to play each shot by itself — to forget what has gone and think only of the shot immediately before you." [1]

Illustrations from pathological cases. The harmfulness of preoccupation of either a pleasant or an unpleasant sort is seen in extreme forms in cases of mental pathology. The melancholic person is one who is so absorbed in his painful brooding over the possible evil consequences of any attempt which he may make that his vigor is destroyed and he is incapable of strenuous effort of any sort. On the other hand, the light-hearted, irresponsible person whose time is mainly occupied in building air castles, is incapable of engaging in serious endeavor, because he finds such mental dissipation more agreeable than attacking the difficulties of an actual situation. These cases represent extremes, but it is possible

[1] *American Magazine*, July, 1915.

to find illustrations of a less serious effect upon one's efficiency of either unpleasant or pleasant preoccupation with the past or the future, instead of absorption in the present.

Practice mental economy by doing a thing but once. It has become the fashion since attention has been given to efficiency in work, to post upon one's desk brief mottoes which epitomize principles of economy. One such motto is the often met *Do it now.* A very important principle is contained in this simple direction. We waste numberless hours in thinking about duties and tasks and then putting them off. Each time we reconsider the matter and put it off more energy is wasted. In the meantime the task begins to look harder and harder, and a persistent vague consciousness of it prevents whole-hearted devotion to the matters in hand. Sometimes such postponement is necessary, but usually it is a source of unnecessary weakness. By doing a task at the appropriate time it is done only once, but by putting it off it is in effect done many times.

"The philosophy of the flat-top desk." In this apt phrase a writer in a periodical some years ago summed up a principle which he said had transformed his method of work from inefficiency to efficiency. With the use of a roller-top desk had grown up the habit of never finishing his tasks — of accumulating a great mass of material on his desk which represented unfinished work, and then of escaping from the challenge of this work by pulling down the cover. A happy inspiration showed him that his difficulty was due to a procrastination which caused him to shrink from facing his problems and tasks and having it out with them; and in order to force himself to a revolution of his habit he adopted the flat-top desk, which had to be cleared off every night before he stopped work.

Taking stock of the past and forecasting the future has an essential place. It is, of course, not to be concluded that a per-

son should be like the brute, incapable of imagination, and unable to modify his action in accordance with his past experiences or to direct his conduct by anticipating its future consequences. What is meant is that the backward or the forward look is chiefly to be taken when one is viewing one's life from a more or less detached standpoint, — when one is not in the midst of the execution of the work. Such is the occasion for taking stock of the past and planning for the future.

Self-consciousness hampers free and vigorous action. Another form of preoccupation which is very harmful in its effect upon efficient performance is undue thought or anxiety for one's self. This is so well described by Professor James, that we shall quote his account of the matter: —

> Now from all this we can draw an extremely practical conclusion. If, namely, we wish our trains of ideation and volition to be copious and varied and effective, we must form the habit of freeing them from the inhibitive influence of reflection upon them, of egoistic preoccupation about their results. Such a habit, like other habits, can be formed. Prudence and duty and self-regard, emotions of ambition and emotions of anxiety, have, of course, a needful part to play in our lives. But confine them as far as possible to the occasions when you are making your general resolutions and deciding upon your plan of campaign, and keep them out of the details. When once a decision is reached and execution is the order of the day, dismiss absolutely all care and responsibility about the outcome. *Unclamp*, in a word, your intellectual and practical machinery, and let it run free; and the service it will do you will be twice as good. Who are the scholars who get "rattled" in the recitation room? Those who think of the possibilities of failure and feel the great importance of the act. Who are those who recite well? Often those who are most indifferent. Their ideas reel themselves off out of their memory of their own accord. Why do we hear the complaint so often that social life in New England is either less rich and expressive or more fatiguing than it is in some other parts of the world? To what is the fact, if fact it be, due, unless to the overactive conscience of the people, afraid of either saying

something too trivial and obvious, or something insincere, or something in some way or other not adequate to the occasion? How can conversation possibly steer itself through such a sea of responsibilities and inhibitions as this? On the other hand, conversation does flourish and society is refreshing, and neither dull on the one hand, or exhausting from its effort on the other, wherever people forget their scruples and take the brakes off their hearts, and let their tongues wag as automatically and irresponsibly as they will.[1]

The external conditions may be made an aid to concentration. We have been considering the means by which one may be trained to ignore distractions. It is also desirable, in order that the most efficient work should be done, that work should be so arranged that distractions themselves are avoided. It is unnecessary and undesirable to allow too many disturbing conditions. It is a law of habit that one becomes accustomed to working in a certain place. If one has learned to work at a certain desk, for example, upon sitting down at the desk one unconsciously adopts the attitude of work. While it is undesirable so to hamper one's self that one cannot work except under certain set conditions, yet it is legitimate to take advantage of such helps to concentration as this.

Special principles apply to economy in rate of improvement. We have been considering the conditions which are favorable to the accomplishment of a large amount of work. When we aim primarily, not at the accomplishment of a large amount, but at the improvement in ability, special principles are found to apply. The difference may be illustrated by typewriting. If the aim is to do as much typewriting as possible in a day, the arrangement of work should be different from the arrangement which is most suitable when the aim is to make a certain amount of work produce the greatest improvement in speed or in accuracy. In order to test the effect of the arrangement, we may measure the amount

[1] James, William. *Talks to Teachers*, pp. 220 *ff*.

of improvement which takes place from ten hours' practice when those ten hours are grouped into a single period, or when they are distributed so that one hour is spent in practice each day. If our aim is to accomplish the most in a day or a week, we will adopt a different distribution of our time than if our aim is to improve as rapidly as possible with a given expenditure of time; for it is found that when the time is distributed into fairly short periods, improvement is more rapid than when it is concentrated into longer periods. In applying the principles of mental work to the school child, where the aim is to attain the most economical progress possible, and not to accomplish a large amount of work, it is necessary to take particular account of these special principles of arrangement.

Short periods for young children and mechanical learning; longer periods for older persons and rational learning. A number of experimental studies have been made in order to determine what is the most economical distribution of time in practice. These have not been extensive enough to determine what the best rule is in all cases. Considerable variation has been found according to the age of the learner, or the kind of work which is to be performed. For drill in number work with young children, a period as short as two minutes appears, from one study, to be most favorable; while for learning to make substitutions of one symbol for another as in learning to use a code, adults seem to find half hour periods at least as favorable as a shorter time. It is probable that the more mechanical and the more difficult a form of learning is, the shorter is the period which gives the most rapid improvement for a given amount of time expended. It would be wasteful to give an extremely short period to the study of a subject which involves the development of a train of connected ideas, such as geography, history or literature; but it is probable that in the drill subjects the shorter periods are

the most favorable. More experiments than we have should be made under school conditions in order to give us detailed information on this point.

Slow progress from long practice periods may be due to various causes. The reason that periods which are too long give less rapid improvement than those which are shorter is probably to be found mainly in the fact of fatigue. As the learner becomes wearied with his work, he may be able to prevent very much decrease in the speed or in the accuracy of his performance; but the amount of fatigue may be sufficient to prevent the formation of new associations, and therefore enough to prevent any large amount of improvement in his work. It is possible also that when one continues work under such circumstances, the unconscious impulse to avoid or to escape from the increasing fatigue leads one to adopt other ways of performing his task than those which are most effective, and in this way to form wrong habits. The particular ways which have been found to be most efficient may have resulted in a special fatigue for those especial acts. It is also possible that during the interval between practice periods one's nervous system continues the work of organization. We know that a tune often runs in the head in spite of our desire to banish it. It is possible also that the nervous changes which accompany other mental or physical acts are carried on in part during the intervals between practice. In application of these principles it is apparent that it is better to carry on several of the more mechanical forms of learning at once and to distribute the time into fairly short periods of time, rather than to concentrate altogether on one kind of work.

3. *The mental attitude and efficiency*

"It is intense effort which educates." We have seen that the organization of work into favorable periods and the

planning of work influences the mental attitude by making it easier to ignore distractions. There are also certain positive attitudes of mind which are necessary in order that the highest efficiency may be attained. Bryan and Harter in their study of the telegraphic language conclude that it is "only intense effort which educates." Practice which is carried on in a lazy manner, or with an indifferent attitude of mind, does not produce improvement. Improvement is always at the cost of strenuous effort to rise from a lower to a higher plane of accomplishment.

Effort must be rightly applied or it produces confusion. It is true that an intense desire to improve, especially if there is something at stake, is the condition of the most rapid progress. Not all effort, however, produces a favorable effect on learning. Intense effort may sometimes result not in better directed efforts, but rather in confusion, in making mistakes and therefore in retrogression. In order that effort may be beneficial it must be rightly applied, and this means that it should be applied at the proper time and in the proper degree. If one attempts to push on too fast at a stage in which his control over his movements or ideas is rather weak, he will become confused. This may be illustrated from typewriting. If the beginner attempts to write too rapidly he will make mistakes and form the associations of the letters with the wrong keys. Effort must be applied steadily aud must be applied in a discriminating way so that one shall continually make progress to the higher-order habits without proceeding so fast that the partially developed lower-order habits are broken up.

The effort to gain concentration often produces divided attention. One form of the application of effort which is frequently met with is the attempt to concentrate the attention. It has been implied frequently in previous chapters that the attention must be concentrated in order that the

work shall be efficient. This does not mean, however, that one can best attain concentration of attention by *directly* setting out to do so. Watt, in his *Economy and Training of the Memory*, puts the matter graphically and truly when he says: "Most students have a period in their life when they go in for concentration and come out with a headache." The difficulty with concentration, when it is sought for in this manner, is that one actually does not attain concentration but rather a divided attention and a strained attitude of mind which is unfavorable to efficiency. What the student does under these circumstances is to continue to think to himself, "Now I must keep my attention concentrated." He in this way is keeping half of his attention upon his attention itself, while he tries to give the other half to his work. What he should do is to forget all about his attention and give his mind wholly to the work in hand. The manner of doing this is to become so absorbed in the task that one forgets all about the attention or any of the other mental processes which are involved in the work. The student engaged in mental work needs to think about his attention only when he finds it to be wandering from the subject, and then only long enough to bring it back. He must learn instantly to detect the wanderings of his attention, but apart from such watchfulness can leave his attention to take care of itself.

Confidence stimulates effort. It is necessary to understand further certain of the conditions which underlie the application of effort in the performance of any task, or in learning. We cannot apply effort merely by saying to ourselves, "Now I will exert my greatest effort." The application of effort depends on other conditions of mind than mere resolve, and one of these is a certain degree of confidence in one's ability to succeed in the task which is undertaken. Confidence in one's ability results in the stimulation of

one's mental and physical power and in the release of energy for the task. The consciousness of failure and the expectation of failure, on the other hand, result in a drying up of the sources of one's energy entirely independently of one's desire or intention.

Consciousness of success is the most effective basis of confidence. Confidence is based upon previous success. However one may endeavor to work up artificially a feeling of confidence, one is always influenced to some degree by previous failure or success in this particular sort of work, or in work in general. As a consequence of this fact it is necessary that the work of the child be so managed that he shall possess the required degree of confidence in his ability. This means that we should gauge the task which is set for the child so that it is within his ability to perform it. One who has driven horses knows that in order to get from them the greatest effort of which they are capable, it is necessary to avoid trying to force them to pull at a load which is beyond their capacity. When they have once felt that the load is beyond their power, they cannot be induced to put forward their best efforts. This paralyzing effect of failure is evident in the case of children who have to repeat a grade. It is a matter of common observation that such children never work so hard as those who are taking the grade for the first time. Children who have failed in part of their work have been found to do better work if they were promoted than if they were made keenly conscious of their failure by being forced to repeat a grade. We may sum up this matter by saying that it is necessary to maintain the worker's good-will in order to get the full expenditure of effort.

It is a mistake to make an overdraft on good-will. This principle should be applied in the arrangement of a program. The notoriously futile character of New Year's resolutions is due to the fact that one makes altogether too large a draft

upon his good-will. One sets out to revolutionize his life at a stroke, and as a matter of course soon finds that such an attempt is entirely beyond human power, and therefore gives up the whole matter. In determining upon any new course of action, or in determining upon any form of effort, it is better to be somewhat conservative and to underestimate one's ability than to go to the opposite extreme.

The atmosphere of success is a potent source of confidence. Confidence is based, not merely upon one's previous success, but also to a large extent upon the atmosphere in which one works. One gains confidence to some extent through contagion or suggestion from others. It is a matter of common observation that one plays a better game with good players than with poor players. In the first case the atmosphere causes the player to expect to do the right rather than the wrong thing, and he falls in with this expectation.

The attempt to avoid failure must not be allowed to produce softness. What has been said about the necessity of success must of course not be interpreted in such a way as to develop a softness of mind which is utterly in opposition to any robust effort whatever. If the child has such a fear of failure that he never attempts anything in which there is any risk, a state of mind is produced which results in a low estimation of his powers and a continual fear of failing. A too obvious attempt to make the child's tasks so easy as to preclude failure simply makes him conscious of the danger of failing. It is necessary that he should develop the ability to face and overcome possible or actual failure. He must be able to attempt tasks which are sufficiently taxing to call out the highest efforts. In such cases he must occasionally meet failure, and must then develop the ability to surmount failure and try again. Failure is bound to occur sometimes, entirely independently of one's responsibility, and one must be able to meet failure of this sort, or of any other sort. More-

over, a child is not interested in a task which is too easy, which does not call for strenuous endeavor and in which there is absolutely no risk.

When failure is injurious and when wholesome. How then shall we reconcile these apparently opposing principles? We may say that while the child must learn to meet failures, the failures must not be so frequent or so disastrous as to cause him to lose confidence in himself. He must be gradually led to endeavor to accomplish more and more difficult things, and the task must be suited to his powers so that, with the best expenditure of effort of which he is capable, he can in most cases succeed. He must learn to face possible failure and to overcome occasional failure while at the same time maintaining a confidence in his own ability to meet adequately the tasks which are before him. The failure must, so to speak, be kept outside the citadel of his real self. It must not produce a sense of incapacity which becomes so prominent as to prevent the expenditure of effort. But failure in a task which is within the child's power is often necessary in order to arouse him from a complacent and indolent frame of mind and to stimulate him to exert himself.

4. Nervousness

We have been considering some of the special conditions which govern one's efficient adaptation to the task in hand. There are conditions outside the learner such as the proper organization of work into periods, and inner conditions, such as the proper application of effort, which are of importance. There is also an attitude of mind which hinders our adaptation, and which is to be treated not as related to special aspects of the organization of the work, but rather as a general mental condition which is to be treated by general measures. This general condition is an inner state of the mind which is not produced by special outward circum-

stances but which is characteristic of all one's mental operations. This condition is nervousness.

Illustration from a case of temporary nervousness. This does not refer to a temporary nervous condition which may arise under special responsibility, but rather to a more permanent condition which affects the whole mental life. The characteristics of nervousness in general, however, may be illustrated by the temporary condition with which all are familiar. Suppose that one is to make a public speech, or engage in a public contest which is out of the usual for him, and which causes nervousness. The characteristics of such a state of mind well illustrate nervousness in general. Abnormally intense feelings are aroused by the occasion. There is an anxiety as to the possibility of performing the task in a proper way. There is an exaggerated fear of failure and of the unpleasant consequences which would result from failure. This fear and anxiety leads one to think of all sorts of mishaps which may produce failure, of all sorts of ways in which something may be done wrong. The mind is abnormally active in producing trains of thoughts of impending disaster. One is incapable of controlling these thoughts so as to keep the mind on the task which is to be performed. This means that the nervous condition itself produces the result which is feared. There is also a hesitating, wavering, state of mind which makes it difficult to come to any decision. There is the scatter-brain type of conduct which one commonly associates with a nervous person. As a result of all this, a person loses very greatly in efficiency because he cannot direct his thought or his actions consistently toward any one aim.

Neurasthenia is nervousness which is caused primarily by physical debility. This gives a rough picture of the condition of a nervous person in general. Before going into a more detailed account it is necessary to distinguish two different kinds of nervousness. The symptoms are in many respects

very much the same, but the causes and the mode of treatment differ in the two varieties. The first type of nervousness is physical in its origin, is caused perhaps by an improper kind or amount of food, by lack of proper rest, by overwork, or by unfavorable conditions of various sorts. These conditions result in the depletion of energy in the nervous system. The condition is then primarily a physical one. This depleted condition of the nervous system results in the mental symptoms which are characteristic of nervousness. This type of nervousness is called "neurasthenia," and the remedy for it is a change in the conditions which have brought it about. Ordinarily rest is required and such a regimen of life, including proper food, rest, and exercise, that the patient will be built up physically. When this is done the mental symptoms will disappear.

Psychasthenia is nervousness due to bad mental habits. Modern specialists in nervous diseases have distinguished another cause of nervousness and have given to it the name "psychasthenia." Psychasthenia, as distinguished from neurasthenia, is mental in its origin. It is fundamentally the acquirement of bad mental habits. These may be acquired without any assignable physical cause. There probably is, however, a predisposition to them in the inherited characteristics of the nervous system. They are often produced in whole or in part by the association with other persons from whom the child imitates bad mental habits as they appear in the conduct of other persons. The remedy in such a case is education. While in the former type it is usually necessary to rest, in the latter case it is rather necessary to occupy the patient in light, but regular work, which engages his attention and prevents his dwelling upon those ideas which produce anxiety and too much thought about himself.

Treatment should be preceded by a diagnosis by a competent physician. If a child exhibits signs of nervousness it

is first necessary that a diagnosis be made in order that it may be determined whether the nervousness is of mental or physical origin, because the treatment which should be given will depend entirely upon this diagnosis. The teacher is not in a position to make such a diagnosis nor to prescribe treatment in detail. Such diagnosis and prescription must be made by a competent physician. It is, however, desirable that the teacher should know what the symptoms and the forms of treatment for such nervous conditions are, in order that he may detect the extreme cases and call the attention of the parents or of the school authorities to them, and in order that he may intelligently carry out such forms of treatment as may be possible in the school.

Important symptoms — (1) undue emotional excitement. We may illustrate further a few of the symptoms which have already been mentioned in order to make it possible to recognize the more extreme cases of nervousness. The first of these is undue emotional excitability. A nervous person tends to go to an extreme in any of the emotions. He may be unduly fearful, may give way to fits of extreme anger, or may be unduly excited to joy by some trivial event of his experience. Whenever the child seems to exhibit an emotion which is out of proportion to the occasion for it, it is appropriate to inquire whether he may not be suffering from nervousness.

(2) **Fluent thought of possible evil.** Along with this undue emotional excitability, goes an unusually fluent train of association of certain kinds of ideas. These ideas are concerned particularly with some possible injury to one's self or to those to whom one is closely related. A nervous person is particularly adept in anticipating all possible calamitous consequences of everyday happenings.

(3) **Self-centered attitude.** It will be noticed that the fears and anxieties and ideas of the person afflicted with nervousness center about himself, and as a result of these facts the

nervous person is notoriously self-centered. This may or may not appear in the form of selfishness. It may appear as self-condemnation and self-abnegation.

(4) **Indecision.** The too fluent trains of associations which characterize the nervous person, leading him to think of all sorts of unpleasant consequences of any proposed course of action, make it very difficult for him to make up his mind to any course of action. Therefore one of the most common symptoms of nervousness is indecision. The training in decision of persons who are disposed to nervousness has been found useful. One method is to require him to play checkers and to decide on each move within some definite, short interval of time.

Foster's maxims for acquiring decision. J. Foster, in his *Essay on Decision of Character*, gives a number of practical rules which indicate how stability and firmness of decision may be cultivated. The most important of his rules are: (1) Gain an adequate knowledge of the enterprises which are to be undertaken. This gives confidence in the justness of one's decisions and makes it unlikely that facts will be encountered that will make it necessary to reverse them. (2) Form the habit of thinking through all questions which come up for decision by following out a connected train of thought to a conclusion. Do not be swayed by the consideration which happens by chance to be uppermost at the moment. (3) After forming a decision promptly commit yourself to it by definite action, which, if possible, makes a reversal of the decision difficult. Knit together resolution and action so closely that no gap between them appears. The whole essay is stimulating and instructive.

(5) **A sense of weariness and incapacity for work.** The anxiety and emotional excitability of the nervous person unduly arouses his nervous system and results in a permanently excited or stimulated condition. This frequently results in

insomnia or disturbed sleep which further weakens the nervous system. The nervous system in such cases is not merely aroused to respond to the demand upon it, but is excited when there is no demand, or out of proportion to the demand, and thereby wastes energy. As a result, the person so afflicted has a continual feeling of fatigue and of inefficiency, and this feeling is heightened by his inability to keep his mind upon his work. The whole condition renders the afflicted person incapable of the normal amount of work. This incapacity may be due entirely to conditions which are mental in their origin and may not be due to any permanent physical incapacity whatever.

5. *Treatment of nervous children*

Those who govern the child must be self-controlled. The remedy for these conditions will depend, as has been said, upon the type of nervousness. We may dwell here upon the type of training which is chiefly suited to the person whose nervousness is mental in origin. In the first place, it is necessary, in order that the child may be trained to healthy mental habits, that those who surround him shall themselves have the healthy mental attitude. As nervousness may be caused in a child by imitating nervous people, so nervousness may be overcome in him by having persons to imitate who themselves are calm and collected in their thinking and their actions. The child must be treated entirely as a person who is sick in mind and not as a person who is obstinate or willful or bad in any moral sense. This makes it doubly necessary that the person who has the child in care shall himself be able to control completely his own feelings and reactions toward what the child may do. The child must never be punished for actions which are the expressions of nervousness, since this does no good whatever, but merely accentuates the difficulty.

The child's attention must be directed away from his ailment. Besides having proper models for imitation, it is necessary that the child have the correct mental attitude suggested to him. He must not be led to think of himself as nervous, or hear the word *nervousness* mentioned. Since nervousness is in a large measure induced by self-examination and too keen a sense of one's self, it is desirable that the child should come to develop an attitude of mind which is objective instead of self-centered, and this necessitates that he shall not have his attention called to his condition or be led to think that it is in any way abnormal.

Overstrain must be avoided. The demands which are made upon the nervous child should be suited with particular care and discrimination to his abilities. It is necessary that all overstrain or overwork shall be avoided. This means that he shall not be unduly stimulated, — for example, by competition, — but that his energy should be called forth by his interest in the work which he is performing rather than by any external excitement. It does not mean, however, that the child shall be excused from work. Regular occupation is one of the necessary conditions for the recovery of mental health.

The child must not be overindulged. Although the child must not be overstimulated, and too strenuous demands must not be made upon him, he must at the same time not be indulged. Overindulgence is perhaps worse than overstimulation, or at least as bad, since it leads to the self-centered and self-indulgent attitude which is the soil for all the imaginary ills which affect the neurasthenic or psychasthenic person. The external conditions for physical health must of course be maintained with special care in the case of the nervous child.

An abundance of outdoor activity is essential. The value of outdoor exercise as a general measure of hygiene through

its stimulating effect upon circulation, appetite and assimilation of food, and the elimination of waste products from the body — and as a consequence of this bodily effect its promotion of mental energy and health — is unquestioned. The value of the outdoor régime is double in the case of children, because it is during the period of childhood that the physical and mental character is largely being moulded. Right bodily and mental habits formed during childhood are valuable insurance against breakdown in later life. In the case of nervous children plenty of outdoor life is imperative, since they have multiplied need of every possible help in maintaining stability and self-control.

The older child must be taught to order his life rationally. As the child grows older he must be taught to take himself in hand resolutely and govern and direct his conduct and his life in a rational manner. He must learn to keep his mind engaged in healthy thoughts and to combat his fears and anxieties by turning away from them, and by using reason and common sense. He must learn to keep himself occupied in vigorous work, and at the same time to adopt a rational program so that the work shall be alternated with recreation and exercise and a proper amount of sleep. He must learn, in general, to look upon himself as something objective which needs rational treatment and to resolutely give himself the sort of treatment which he needs.

Summary. We have endeavored to show in this chapter how one may most effectively govern or direct his mental processes and his program of life so as to accomplish his work with the greatest economy and the highest degree of mental health, and how the same principles may be applied to the development of efficient habits of the child. Some of the conditions of efficiency have to do with special circumstances, and some have to do in a more general way with one's mental health and one's general attitude. The whole matter may be

the aim of the mind
summed up by saying that the aim of the conduct of one's mind is the most efficient adaptation possible to the conditions of one's life. This adaptation can be attained in some circumstances through special organization of one's time or one's energy. In other cases it is a more general matter, and involves the attainment of a healthy mental attitude. The intelligent application of these principles depends not merely upon an appreciation of their truth in general, but also upon an individual study of each case, and an application of the principles in detail in such a way as to meet the needs of each case.

QUESTIONS AND TOPICS FOR DISCUSSION

1. Tell briefly what you understand by fatigue, weariness, and mental and physical fatigue.
2. Give illustrations from your experience to show that the course of mental fatigue is not entirely simple.
3. Name two kinds of mental work, one of which appears to be more and the other less seriously affected by fatigue.
4. Would you talk to the child about being tired? If so under what circumstances?
5. Mention any general rules for planning work, rest, recreation, and food that you think are valid.
6. Qualify the statement that healthy-mindedness requires preoccupation with the present.
7. Describe any external conditions that you have found either a help or a hindrance to concentration.
8. Why do somewhat different principles apply to rapidity of improvement as compared with amount of accomplishment?
9. Distinguish in your own experience between beneficial and harmful effort.
10. Is a winning or a losing team more apt to succeed, irrespective of their real strength? Why?
11. Describe individual differences in self-confidence which need to be taken into account.
12. What sort of treatment of a nervous child is safe whatever the origin of his nervousness may be?
13. Where should a nervous child's attention be directed?
14. Does outward calm always indicate real self-control?

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The asterisk indicates that the term is formally defined on the page indicated.